DOCUMENT RESUME

ED 062 824 EM 009 894

AUTHOR	Davies, Ivor K., Ed.; Schwen, Thomas M., Ed.
TITLE	Toward a Definition of Instructional Development.
INSTITUTION	Association for Educational Communications and Technology, Washington, D.C.
PUB DATE	Apr 72
NOTE	91p.; Paper presented at the Association for Educational Communications and Technology Annual Convention (Philadelphia, Pennsylvania, March 1971)
EDRS PRICE	MF-$0.65 HC-$3.29
DESCRIPTORS	Educational Development; Educational Strategies; Information Processing; *Instructional Design; *Instructional Improvement; *Instructional Programs; Instructional Systems; Teaching Methods; Teaching Procedures
IDENTIFIERS	*Instructional Development

ABSTRACT

A new division of the Association for Educational Communications and Technology (AECT), the Division of Instructional Development (DID), invited papers by five leaders in the field to provide a starting place for defining and exploring instructional development (ID). The first paper argues that definitions are restrictive and should be used only as guidelines, and that ID should employ convergent methodologies. The second paper suggests that ID is a process for improving the quality of instruction, but stresses the importance of human factors in the design and management of an instructional system. A different approach is taken in the third paper--it is argued that ID needs to rest on a solid basis of theory rather than on raw empiricism, and that it can be viewed within the context of information processing. The discussion in the fourth paper centers around the idea that ID is data based by its very nature, and for this reason, its basic assumptions and procedures must be constantly re-examined. The final paper argues that ID is a systematic activity designed to ensure that relevant instructional objectives are realized in the context of an effective learning activity. (Author/SH)

ED 062824

AECT

Toward A Definition Of Instructional Development

Edited by

Ivor K. Davies
and
Thomas M. Schwen

U.S. DEPARTMENT OF HEALTH, EDUCATION & WELFARE
OFFICE OF EDUCATION
THIS DOCUMENT HAS BEEN REPRODUCED EXACTLY AS RECEIVED FROM THE PERSON OR ORGANIZATION ORIGINATING IT. POINTS OF VIEW OR OPINIONS STATED DO NOT NECESSARILY REPRESENT OFFICIAL OFFICE OF EDUCATION POSITION OR POLICY.

Papers presented to the Instructional Development Division of the Association for Educational Communications and Technology, Philadelphia, March 1971.

EM 009 894

Table of Contents

Page

Preface i

The Five Contributions: A Personal Overview 1

Dr. Ivor K. Davies
Dr. Thomas M. Schwen

Indiana University

Contribution One: Toward a definition of instructional development: an eclectic approach 7

Dr. Robert Heinich
Indiana University

Contribution Two: Toward a definition of instructional development: a systems approach 18

Dr. Kent Gustafson
Michigan State University

Contribution Three: Toward a definition of instructional development: a theory based approach 38

Dr. David Merrill
Brigham Young University

Contribution Four: Toward a definition of instructional development: an empirical approach 63

Dr. Leslie Briggs
Florida State University

Contribution Five: Toward a definition of instructional development: an organizational approach 70

Dr. Dale Hamreus
U.S. International University

Postscript 86

Preface

As a result of the new 1970 constitution for the Division of Audio Visual Instruction, a number of organizational changes were made possible. These permitted the formation of divisions and affiliates, and also precipitated a change in name from DAVI to AECT (the Association for Educational and Communications Technology). The first annual meeting of AECT took place in April 1971 in Philadelphia.

Previous to this meeting, a spontaneous interest in instructional development had occurred, and the 1971 AECT convention was seen as an opportunity for institutionalizing this interest under the auspices of a professional society. A Division of Instructional Development (DID), therefore, was created at the Philadelphia meeting, with an initial membership of 100. The first DID president was Professor Richard Stowe of Indiana University, with Professor Kent Gustafson of Michigan State University as president-elect.

Many informal discussions took place before the Philadelphia convention, and it soon became obvious that there were many different views of the nature of instructional development. The first act of the new division, therefore, was to invite five national leaders to contribute papers in which they explored their personal views of the field. No restrictions were placed upon them other than that they should speak to the general theme of the two-day symposium of "Toward a definition of instructional development." These five papers are presented in this monograph as the forerunner of what can only be a continuing and evolving dialogue. It is envisaged that further monographs will be published in this DID series as the need and opportunity arises.

3 A

The Five Contributions:
A Personal Overview

Ivor K. Davies
Thomas M. Schwen

Although instructional development is seen as an important, yet-evolving area of educational concern, few people outside the immediate ID area find useful definitions of the field in the professional literature. For this reason, these five contributions represent formative milestones.

Some will find their mutual contradictions upsetting and will ask for a tighter and more precise definition of the field. Others will recognize the importance of having an essential dynamic view of the field at this early date. Both viewpoints have much to commend them, but the leadership of DID has tended to adopt the latter view.

Viewing these five conflicting and contradictory contributions toward a definition of instructional development, however, reveals an orchestration of common theme--often dissonant but with the promise of harmony to come.

> Capsule 1: A personal interpretation of Professor Heinich's eclectic approach toward a definition of instructional development.

Professor Heinich argues that definitions are restrictive and therefore one should be wary of them in conceptualizing instructional development. They may be too narrow; often they are institutionally bound, and they are necessarily limited by the very property of being a definition. He suggests, therefore, that in conceptualizing ID, a definition should be nothing more than a guideline.

Instructional development, he feels, utilizes theories of instruction, which by their very objective tend to be prescriptive in nature. He emphasizes that ID should employ convergent methodologies, rather than divergent ones which are more characteristic of traditional research. In this way, the instructional developer is able to choose from a wider and richer range of instructional alternatives.

Dr. Heinich goes on to suggest that instructional development, as presently conceived, is quite often institution bound. Since most educational institutions are traditionally used to procuring instruction, rather than developing it, the full potential of instructional development may never be realized. There is, therefore, a real need for ID to free itself of the constraints traditionally involved in organizational choice. Only in this way will it be likely to generate sufficient alternative futures.

Capsule 2: A personal interpretation of Professor Gustafson's systems approach toward a definition of instructional development

Professor Gustafson argues that instructional development is a process for improving the quality of instruction. In this sense, there is a real correspondence of his views with those of Professor Heinich. He agrees that development is necessarily eclectic and pragmatic in both origin and development, but differs from Dr. Heinich in believing that it is also predominantly behavioristic. Systems thinking, accordingly, is both a useful and empirical principle in the total development process.

In considering systems thinking, Dr. Gustafson makes three distinctions. He argues for development as an instructional system, the use of systems concepts in development, and the products of development as instructional systems in their own right. In this sense, instructional development is viewed from a descriptive and divergent rather than prescriptive and convergent point of view.

Unlike the other four contributors, Professor Gustafson stresses in his paper the importance of human factors in the design and management of an instructional system. In this sense, at least, he belies the mechanistic view that is tending to taint the field of instructional development--at least from the point of view of many of those viewing the field from the outside.

Capsule 3: A personal interpretation of Professor Merrill's theory based approach toward a definition of instructional development

Professor Merrill argues that instructional development needs to be based on a solid basis of theory rather than on raw empiricism. He agrees with Professors Heinich and Gustafson that instructional development is somewhat pragmatic in origin and practice, and he agrees with Dr. Gustafson that is is behavioristic--although he is somewhat broader in perspective. Unlike the previous two contributors, however, he also appears to possess the characteristic determinism of many classical theory builders.

This deterministic viewpoint influences him to view instructional development within the context of information processing. The experimental study that he describes is a nice exemplary of this particular viewpoint, which naturally leads to his belief that there is a optimal information processing strategy for all learners and across all categories of behavior.

From this basic assumption, Professor Merrill appears to be suggesting that once these optimal strategies have been determined, the developer's primary task is to design an instructional system so as to implement them.

Capsule 4: A personal interpretation of Professor Briggs empirical approach toward a definition of instructional development

Professor Briggs argues that instructional development is by its very nature data based, and for this reason it must constantly re-examine its basic assumptions and procedures.

In essence, he is behavioristic and pragmatic in approach, but above all he is empirically oriented. Unlike Professors Heinich and Gustafson he does not appear to value an eclectic viewpoint; and unlike Professor Merrill he eschews a deterministic approach. This neat mixture of pragmatism, behaviorism and empiricism underlies his powerful analyses of the problems of instructional development.

Dr. Briggs values a mixture of creativity and practicality. He considers that an instructional developer must by his very commitment question his own basic principles and procedures. Only then is he entitled to question traditional instructional practice. In his long discussion of the many areas requiring investigation, Professor Briggs appears to be warning instructional development that it must become its own model.

Capsule 5: A personal interpretation of Professor Hamreus organizational approach toward a definition of instructional development

Professor Hamreus argues that instructional development is a systematic activity designed to ensure that relevant instructional objectives are realized in the context of an effective learning activity. Like Professor Gustafson, his salient characteristics are his eclectic and pragmatic approach. This is marked with a certain degree of determinism, which tends to identify his concept of instructional development with a non-organic type of model.

He realizes, however, that this deterministic approach doesn't always work. A certain degree of intangible skills such as creativity and "artistic" sensitivity are requisites in order to produce effective products.

Dr. Hamreus stresses that instructional developers must broaden their view of their domain. This can only be done, he argues, if they pay attention to three particular needs:

a. clarify the principles of instructional development

b. develop and perfect the actual "tasks of their trade"

c. gain increased sensitivity to the situational requirements of instructional development by employing appropriate diffusion and adoption models and techniques.

The danger lies in limiting the concept of instructional development: the promise lies in broadening our understanding of both its logic and philosophical base.

Contribution One

Toward A Definition Of Instructional Development: An Eclectic Approach

Robert Heinich

I am going to exercise a prerogative that occurs only once in a professional career and speak from three vantage points, allowing myself the luxury of freely ranging between and among them. As editor of AV Communication Review, I have a very deep interest in the activities of this division because some of those activities are more than likely to show up on its pages. As a member of the division, I have made a personal commitment to its purposes. Finally, as President of AECT, I regard DID as one of the most important of the divisions that have been organized--one that has a great deal of vitality and that represents a major wave of the future. The field of Instructional Technology has always had the dual concerns of how instructional sequences should be structured and how they should be delivered. During a time when political activity tends to be on delivery systems, this Division, I am sure, will serve to keep our other concern clearly in focus.

The Nature of Definitions

In our search for a definition, I venture to offer a caveat. A definition can be restrictive, particularly if it is taken too seriously. Use a definition when it is helpful, but there is no sense in building yourself into a box simply because you feel an urgency to come up with a statement to which all can agree.

A bit of history from our field will illustrate this point, particularly for those of you who are relatively new to the field. In 1963, AVCR (Vol. 11, No. 1) published a special issue that defined what was then the field thus: "Audiovisual communications is that branch of educational theory and practice concerned primarily with the design and use of messages which control the learning process." I didn't like the definition then and I don't like it now because I think it is too restrictive. The text accompanying the definition contained a statement that message selection itself is outside the field, implying a process with discrete, separable steps. This is not consistent with our experience that content and instructional method are interactive and that instructional sequences based on analysis of subject matter are not likely to be the same as those based on task analysis principles. But the 1963 effort illustrates a further caution to definition seekers in that the last decade witnessed a shift from communications theory to behaviorism as the main theoretical input to the field. (Both, by the way, claim to be behavioral sciences.) We should expect a definition based too firmly in one theoretical context not to last. (See Kuhn, 1970) Another attempt at a definition of the field is underway at this time. AECT has received a grant from the U. S. Office of Education to devise not only a definition but also a glossary of terms. Don Ely is chairman of the project, which I'm sure will come up with a product that will serve effectively as guidelines for the field for years to come.

I also raised the point of restrictive definitions at the session on educational technology chaired by Vernon Gerlach at the 1971 AERA Convention. It seemed to me that he was equating educational technology with instr3ctional product design. To me, instructional product design is message design updated. Neither implies an early enough entry into the instructional process and both tend to accept current institutional constraints that in themselves impose restrictions on a definition. A definition of instructional development conceptually should subsume _all_ roles that emerge from the process of instructional analysis. Sometimes, we think we're subscribing to this position when we really aren't. Daniel Bell (1964) once commented that a power base is characterized by a relationship that exists independent of any temporary cast of characters. A definition can be viewed as an attempt to establish a power base. However, most of our instructional development efforts are vulnerable to changes in faculty assignment, and we find that we have built houses of cards. The real power base resides in whoever on the faculty has been assigned responsibility for a specific course. We may have to operate under institutional constraints of this kind, but those constraints should not impose restrictions on the conceptual framework of instructional development as a field nor on its definition.

Defining Instructional Development

We should develop a definition that is independent of any institutional configuration, particularly during a time when the institutions that we have been used to for so long are being threatened, either in the sense of being bypassed or in the sense of being drastically reconstituted. Personally, I believe a definition of instructional development should provide the conceptual basis to reinvent not only the instructional process but also the institutions involved. Examples are the open university in England and the off-campus degree program in New York State. Please read the article by David Hawkridge in the Spring, 1972 (Vol. 20, No. 1) issue of AVCR with this concept in mind.

Instructional Development and Organizations

Within existing institutions, instructional development must enter the administrative hierarchy at a much higher level than traditional media programs. For example, Fred Harcleroad (1967) has suggested two organizational charts, adapted slightly by me, that can serve as guides. I would add that Chart 1 is better for two-year institutions and Chart 2 for four-year colleges and universities although many factors could alter the situation. As for public schools, Chart 3 shows a pattern of organization that could give instructional development the kind of administrative clout not now enjoyed by many school district media programs. The chart refers to the district level program, which I have named, for better or for worse, Curriculum Technology and Instructional Development (or Design). The director would operate on the same administrative level as the curriculum director(s). I would like to point out that school district programs must shift from an emphasis on procurement of instruction, with consequent employment of selection personnel, to design of instruction, with consequent emphasis on development personnel. The rationale of instructional development should push district programs in that direction.

People trained in instructional development should be in a staff relationship and available for assignment where needed in the various departments indicated. For example, if a project of the district is to adapt its collection of off-the-shelf materials to an individualized instruction program, instructional development expertise would be made available to the IMC part of the chart for that purpose. A definition should help guide the setting of standards against which institutional programs and program claims can be measured. A good definition should prevent institutions from making changes in print that are not reflected in practice. This applies not only to Libraries that seem to metamorphose overnight but also to media programs that claim instructional development but in reality remain service and selection oriented.

Theories of Instruction and Development

At an ASCD Convention a few years ago, Bruner (1966) made a distinction between learning theories and instructional theories. Learning theories, he stated, are descriptive, after-the-event explanations of laboratory experiments while instructional theories are prescriptive and attempt to guide a combination of principles from learning theories to achievement of specified results. This distinction is not unique with Bruner. Estes (1960), among others, has stressed the operational importance of distinguishing between the two. Doing so permits us to reach into learning theories for whatever purpose we may have without apologies. I detect a tendency at present to interpret various hierarchies of learning as rigidly prescriptive sequences probably because this procedure has the aura of logical development and exposition. While such hierarchies are extremely useful, too slavish an adherence to them may inhibit fresh and original solutions to instructional problems. As pragmatists, we should worry less about the origins of an instructional solution and more about its effectiveness; let objective evaluation be the judge of the correctness of an instructional sequence. In this way, we don't have to be embarrassed by using, for example, field theories for problem-solving situations. The solutions to those problems may not have their roots in specifically identifiable antecedent behaviors. To illustrate this point another way, a developer might introduce a topic to the student on the level of "analysisi or "evaluation"--not for mastery but for motivation, then move to lower levels of the Bloom Taxonomy, then back up again. Like some of the early programed instruction types, we are sometimes too eager to trade our imaginations for recipes.

The last point I would like to make is a distinction between research methods and development. Standard experimental research methods are, of course, important in establishing fundamental relationships between variables but those methods are not necessarily appropriate to a development activity in a specific real-life situation. Research techniques, for example, are structured to separate treatments, whereas our concern in development may be to find out how to reach an optimal mix of treatments. In a sense the former emphasizes divergence and the latter convergence. One move in this direction is the shift in emphasis from normative to criterion testing procedures; another is the recognition that evaluation of programs should not be thought of as research. We may find that the techniques of operations research are more applicable to large-scale development projects than the research methods most of us were trained in. Nadler (1967) has a provocative essay on the inapplicability of research techniques to design problems.

Conclusion

In conclusion, I would like to reemphasize the necessity of accepting a definition of instructional development that takes cognizance only of the broad functions it seeks to perform and that ignores current institutional configurations. We all have a tendency to define a field by the nature of our participation in it and by the parameters of our own institutional structures. We must free ourselves from those restraints and seek a broader view.

Chart 1

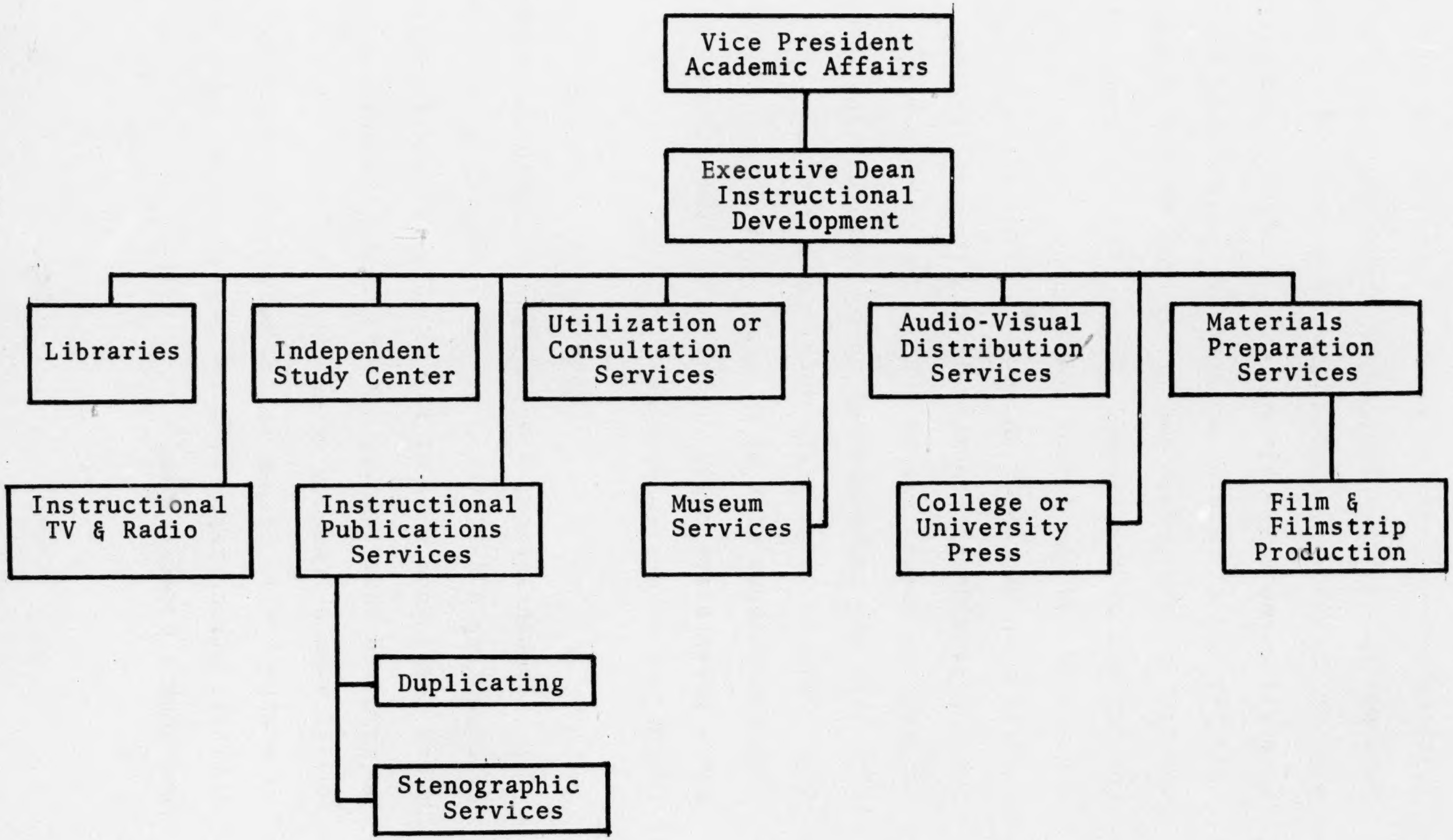

Vice President Academic Affairs
Executive Dean Instructional Development
Libraries
Instructional TV & Radio
Independent Study Center
Instructional Publications Services
Duplicating
Stenographic Services
Utilization or Consultation Services
Museum Services
Audio-Visual Distribution Services
College or University Press
Materials Preparation Services
Film & Filmstrip Production

Chart 2

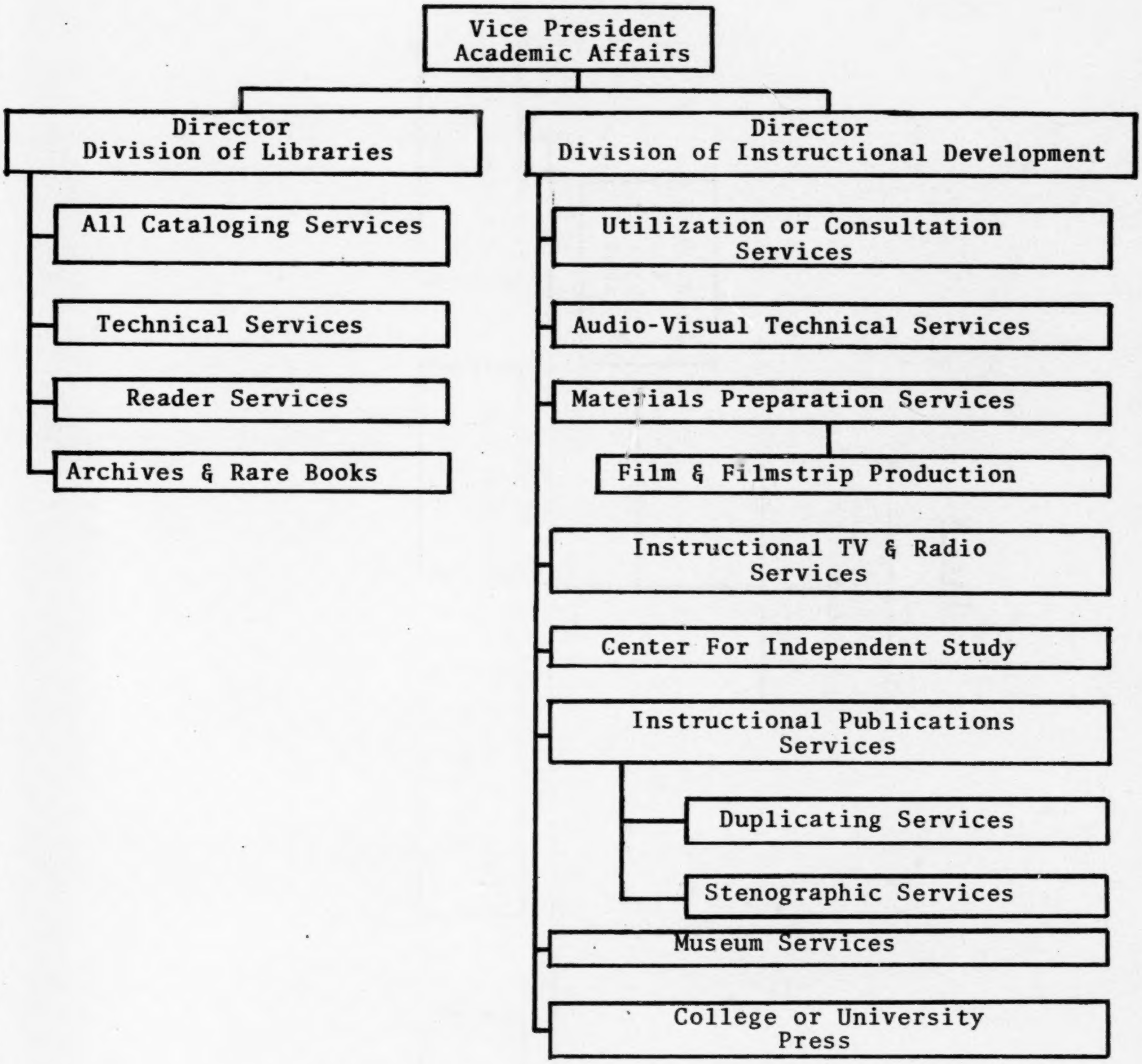
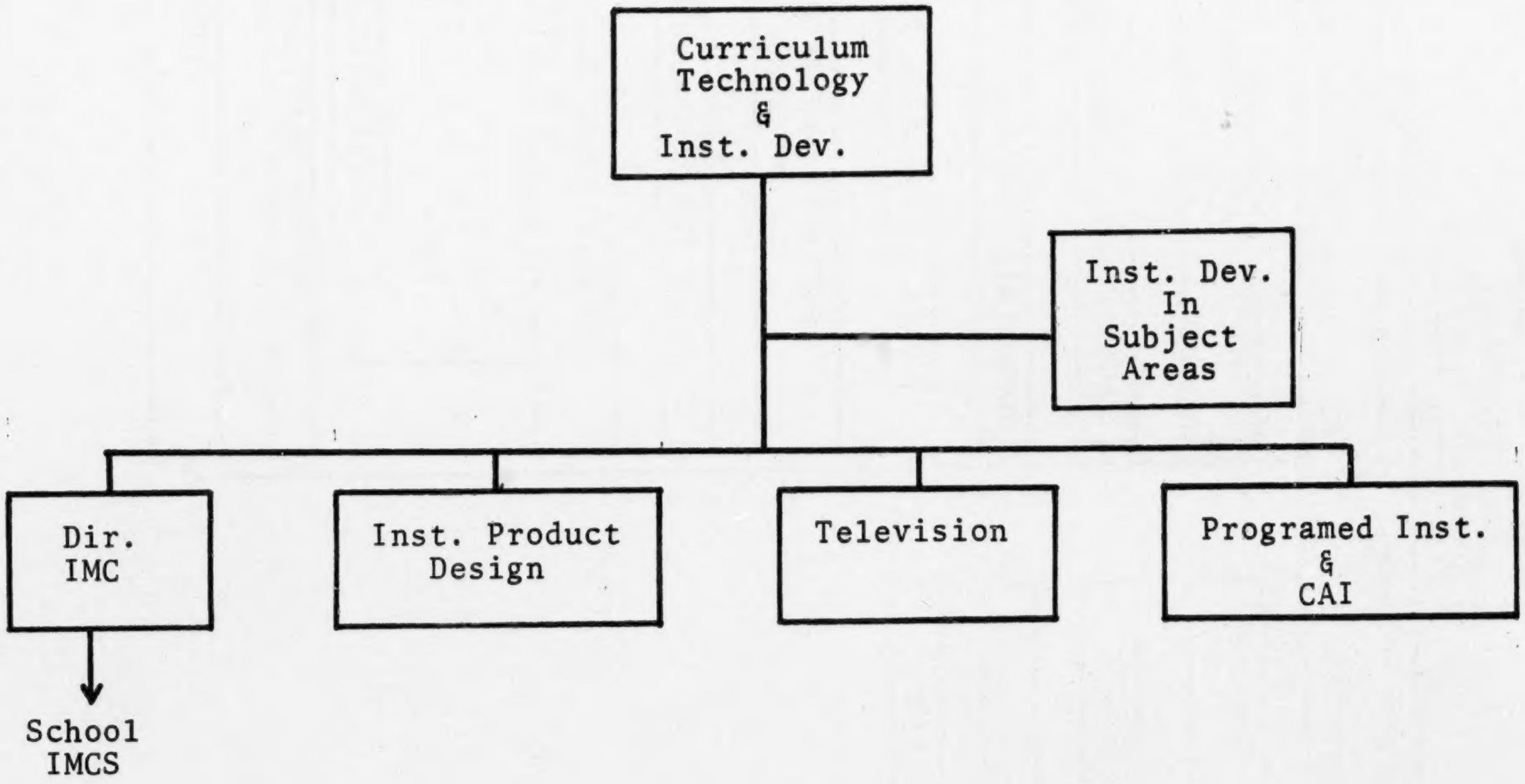

Vice President
Academic Affairs
Director
Division of Libraries
All Cataloging Services
Technical Services
Reader Services
Archives & Rare Books
Director
Division of Instructional Development
Utilization or Consultation Services
Audio-Visual Technical Services
Materials Preparation Services
Film & Filmstrip Production
Instructional TV & Radio Services
Center For Independent Study
Instructional Publications Services
Duplicating Services
Stenographic Services
Museum Services
College or University Press

Chart 3


Curriculum
Technology
&
Inst. Dev.
Inst. Dev.
In
Subject
Areas
Dir.
IMC
Inst. Product
Design
Television
Programed Inst.
&
CAI
School
IMCS

References

Bell, Daniel, "Twelve Modes of Prediction--A Preliminary Sorting of Approaches in the Social Sciences". Daedalus. Summer 1964.

Bruner, Jerome S. Toward a Theory of Instruction. Cambridge: Belknap Press, 1966.

Ely, D. P. (Ed.), "The Changing Role of the Audiovisual Process in Education: A Definition and a Clossary of Related Terms." AV Communication Review, 1963, Vol. 11, No. 1.

Estes, W. K., "Learning". In C. W. Harris (Ed.), Encyclopedia of Educational Research (3rd Ed.) New York: Macmillan, 1960.

Harcleroad, Fred F., "Learning Resources Approach to College and University Library Development" Library Trends, Vol. 16, No. 2, October, 1967.

Hawkridge, David G., "Applications of Educational Technology at the Open University" AV Communicazion Review, Vol. 20, No. 1, Spring, 1972.

Kuhn, T. S. The Structure of Scientific Revolutions (2nd Ed., enlarged) Vol. 2, No. 2. International Encyclopedia of Unified Science. Chicago: University of Chicago Press, 1970.

Nadler, Gerald, "An Investigation of Design Methodology" Management Science, Vol. 13, No. 10, June 1967, pp. B642-B655.

Contribution Two

Toward A Definition Of Instructional Development: A Systems View

Kent L. Gustafson

In attempting to generate a definition of Instructional Development (ID) one is caught in the same web which undoubtedly ensnared Webster and other dictionary compilers: defining a word or concept without using the word or concept. However, the writer will attempt to avoid circular definitions.

Perhaps the best way to define ID is to say it is a process for improving the quality of instruction. For this is, or should be, its goal. Its objective is to combine a variety of human and non-human resources in an effective and efficient instructional system. It is a process applicable at all levels within the formal educational structure and probably also to much informal instruction. I am reasonably certain for example that Walt Disney and his colleagues were and are instructional developers. They certainly know their objectives, their audience, and their product.

Instruction as used here is viewed from the perspective of the designer of the curriculum rather than the learner or consumer of the curriculum. This should not be interpreted as meaning the learner is a passive absorber of information or cannot control his activity while learning. Further and perhaps more importantly, it does not imply ID takes place in the absence of learners. Interaction between developers and learners is a critical element of the process. Thus, instruction is curriculum from the developer's perspective and includes such elements as defining, organizing, sequencing, evaluating, managing and preparation of people for instructional roles. Learning involves only those elements with which the learner interacts.

The Instructional Development Approach

Instructional development, as is suggested in Figure 1, is essentially pragmatic, eclectic and behavioristic. It is pragmatic in that it focuses on what works whether or not an adequate explanation exists. It is eclectic drawing from a number of disciplines including, but not limited to, psychology, social psychology, sociology, management, anthropology and communications. ID is in the enviable position of not being a classical discipline which must defend its boundaries. Rather it is free to draw from whatever sources are useful. It is not grounded in any specific learning theory, but draws from a variety of behavioristic learning theories. The criterion is, "is it useful?"

The Systems Approach

ID is a process often called the "systems approach." While having no argument with those who designate it as such, I feel a precise distinction should be made between the "systems approach" and applying systems theories to the ID process. The former use is to say that the process is in itself a system--which it is. The latter implies conscious and deliberate use of systems concepts as tools while engaging in the process. A third definition centers on the products as being "the system."

Taking the concept of the "systems approach" a bit further, ID is indeed a system. It has all the attributes of a system and is quite comparable to a biological system. First, there is no beginning or end (or at least there shouldn't be). To commence ID activities should not suggest the beginning of the system, for at least part of it predates the developer's initial effort. Further, ID should not have an end since whatever is developed must be continuously re-examined to determine its efficiency, effectiveness and relevance. Another systems attribute is the interdependence of the elements of the system. Anyone who attempts ID rapidly finds that individual elements cannot be singled out for undivided attention since their explication depends on information, decisions and consequences occurring within other elements. For example, one cannot define an instructional problem (often erroneously labeled the "first step") without organizing his management and resources and collecting data (often considered a "later step"). The point is that neither element can occur separately from the other. Further evidence of the interdependence of ID elements becomes apparent as one makes decisions regarding one element which has consequent effects on others. Time is another systems attribute and all instructional developers know how time-consuming the process is. In fact, Bachrach[1] has a law which states, "Things take longer than they do." Whether situation and plan strategies for getting new information into the system.

---

[1] Bachrach's Law, Programed Instruction, the Sixty-sixth Yearbook of the National Society for the Study of Education, Chicago, 1967, page 187.

Another general systems concept has already been alluded to--information flow among elements. The ID specialists who use systems concepts will work diligently to make certain that information flow is rapid and accurate. Systems dissonance, or discord among elements, is also a useful conceptual tool for analyzing and prescribing for a system. Since systems dissonance is dysfunctional and energy consuming, it should also be accounted for and neutralized during development. System stability, or homeostasis, may also be a useful tool for examining stable systems to determine the counterbalancing forces which result in stability. By determining the balance among various forces, the ID specialist is able to make decisions which maximize his effect on the system by selection of critical pressure points. Critical points might include opinion leaders or gatekeepers on the faculty or even the purchasing agent in the business office.

Systems--A Third View!

A third perspective on the concept of systems is to view the resulting products of an ID effort as an instructional system. The term instructional systems development frequently seen in print would seem to support this position. And indeed if human and non-human resources have been combined and the resulting product has demonstrated performance characteristics, it is a system.

Thus, as you will note there are at least three "systems" floating around in the literature and the real world. Whether any author is describing any one or more of those mentioned above or something entirely different is left to your determination.

The purpose of the above is not an attempt to describe all systems concepts which have relevance to the ID process. Rather, it is an attempt to differentiate between (1) ID as an instructional system, (2) the use of general systems theory as one engages in the ID process, and (3) the resulting product as a system. The writer now turns to consideration of the specific elements of the process. The reader is again cautioned that of necessity the writer must select and arrange elements in some sequence. However, in so doing he recognizes the inconsistency of such an arrangement but feels constrained by an essentially linear medium.

Human Factors

Without doubt the most important element of the ID system is people. People are its energy, its insight, its product and its consumer. To engage in ID is to change people. As Alice Miel wrote in Changing the Curriculum, "...the changes invoked when the school curriculum is really modified are actually changes in the attitudes and behaviors of persons." (p. 14) Students, faculty, ID specialists, administrators, other specialists, parents and the general public are all partners in the process. To ignore any segment of the population is to invite frustration and probable failure. Obviously, he was thinking of ID when he generated this law is unknown, but ID is certainly under its jurisprudence!

The biological analogy for an ID system can be carried further. Any organism carries on a variety of functions simultaneously. It must respire, search for, ingest and process nourishment and react to changes in its environment. With but a few exceptions, usually noted by crises, it carries on most functions most of the time with selected ones receiving more attention at any one time than others. Similarly, during ID all functions must receive varying amounts of attention and effort simultaneously if the process is to survive, i.e., progress.

Thus, although it is convenient to construct flow charts and various ID models which indicate the process is linear, such is not the case. I prefer to think of each box in any model or flow chart as indicating the model element which is receiving the greatest attention. To state otherwise is to deny one is operating in a system. Further, any ID system must be flexible in order to react and adapt to changing conditions. The very term process, already overworked in this paper, should connote how the system operates in a synergistic fashion to accomplish its goal.

Another attribute and analogy between biological and ID systems is the information flow among elements. For a biological system to maintain itself information must be transferred from one element to another. In this way various needs of the organism are satisfied. It should be noted that information must flow in both directions between elements and often among elements simultaneously. Likewise, for ID systems to function information must be transferred from element to element. Cyberneticism has labeled this information transfer as feedback but this implies two invalid assumptions. First, that information is not fed forward (or at least such transfer is relatively unimportant since it is not specifically identified). And secondly, feedback assumes a linear mode of operation when in fact, as the reader has already noted, ID is a process. There is no more important element to consider when planning an ID project than designing, maintaining and redesigning the information transfer network within the system and with its external interfaces.

Systems--A Second View

In contrast to thinking of ID as a system, is the notion of using systems concepts during ID. This latter concept of systems is that one can apply systems concepts to the ID process. For example, the concept of open and closed systems is often useful for examining the existing environment within which one desires to conduct ID. If an instructional developer is examining an entire school or school system, he should probably analyze the characteristics of both its formal and informal information networks. Frequently he will find the school is essentially a closed system not permitting outside information into its network. In fact, if one were to generalize, most schools today may be classified as closed systems. By using this systems concept one is better able to define the present depending on the size and scope of the project various members of the above groups must participate in the development. For example, to attempt a major change in instructional strategy with a school or district without involving and changing parents will result in systems dissonance. Not to involve and change affected teachers, administrators, specialists, etc., insures not only dissonance but will also likely lead to discontinuance. Many a good development either failed to be adopted or was rapidly discontinued due to neglect of human factors. Evidence of this fact abounds in the research in social psychology, group dynamics and communications.

The influence of people in the ID process cannot be overestimated. The writer is concerned about the apparent stress of a product orientation in much of the writing on ID. While willing to concede the importance of generating an effective and efficient product, I feel proper weight has not been given to the people involved. I have seen too many examples of faculty members begged, bribed, cajoled and wheedled through an ID project from which a fine product emerged. Unfortunately, the faculty member frequently becomes what could be called an "ID casualty." He is proud of his product as is the returning war veteran of his purple heart but neither wishes to return to the battle. When a faculty member feels this way and one considers the rather short "half-life" of any ID product compared to that of a faculty member, one can only conclude that the project was a failure. While not arguing for poor products I am arguing for more consideration of human factors. A balance must be struck between product development and people development.

Specific ID Functions

Specific functions which must be carried out during development can be classified into four general operations: definition, design, development, and assessment. Each operation is discussed separately below.

Definition of the Situation

Under the general class of definition are a number of subclasses. First is a precise definition or description of what the present situation is. This may include definition of what is believed to be the problem or what one sees as an opportunity to improve instruction. Although we tend to think pathologically about "problems" it is equally possible to think about opportunities. This is more than a semantic play on words. Poor student performance is indeed a problem. On the other hand, if a school acquires a large tract of land, there is an opportunity for instructional development in such areas as conservation, recreation and ecology.

In defining the "problem" one needs to distinguish between symptoms and problems. It is not uncommon for a developer to solve a symptom of a problem rather than the problem. Precise definition of the present situation usually requires information collection from a variety of sources. This "common sense" notion is rather uncommon in general practice, however, it should characterize ID effort. Problems have also been solved which weren't really problems to begin with. Typical types of information might be student performance levels, both pre and post instruction, attitudes, images, and motivation as well as teacher knowledge, attitudes, instructional strategies and motives. Is the problem isolated, department-wide, school-wide, system-wide, etc.?

Also as part of defining the situation, information must be collected, analyzed and summarized concerning the resources which can be brought to bear to solve the problem. Two types of resources must be analyzed: those which can be applied to determining solutions and those which may be available for implementing and sustaining the solution. For example, extra outside resources may be required to generate various media and acquire hardware. However, once these initial costs have been covered, sustaining the system should be less costly. Other resources include personnel with specialized skill in design, development or evaluation and production capability available to the developers.

The instructional setting must also be carefully defined. Within what boundaries must any solution be developed? If there are certain "givens" within which any solution must be formulated they should be specified rather than left as unstated assumptions. First, they may not in fact be givens if sufficient evidence can be collected to demonstrate why they should be changed. And secondly, unstated assumptions in the minds of a team of developers are unlikely to be identical. Other elements of the setting include target audience characteristics and physical facilities. Available instructional resources such as books, media, course outlines, libraries, and community resources should also be specified.

Staff and management controls must also be determined. Staff organization, specific task assignments, information channels, lines of authority and responsibility and fiscal management must all be specified. During development, especially on larger projects, individuals must be assigned specific roles within a team to assure smooth operation. Such roles as management, design, production, evaluation, and communication can be assigned to individuals or even groups of individuals on a very large project. The point is each task is specifically assigned since everybody's job is nobody's job.

In defining staff and management controls it may be desirable to use any of a variety of managerial tools such as flow charts, PERT or PPBS. Such tools can be valuable aids in assuring time and budget constraints are adhered to during all stages of development. They are also useful since they force one to think through the process in at least general terms at the onset.

Specification of objectives is another element of the definition function. So much has been written about objectives that little more probably needs to be said at this point. In fact, objectives often become the starting point for many course development models currently receiving much attention. While the emphasis in current literature is on behavioral objectives stated in terms of learner behavior, project objectives for the instruction being developed are equally important. If an instructional strategy is developed which is effective with some but not all students, it does not meet a project objective which specifies that all students will achieve the objective. Likewise the strategy may be too expensive thus failing to meet project objectives. The writer feels both project and learner objectives must be carefully defined.

Within learner oriented objectives it is usually desirable to determine both enabling and terminal objectives. This classification is of use not type. That is, an objective may be terminal for one segment of instruction and enabling for another terminal objective. Precise definition of objectives not only permits rigorous evaluation of developed strategies but also often suggests instructional strategies for trial.

Performance measures must also be developed. This operation could be considered part of design, but the writer prefers to think of it in conjunction with the objectives. It is usually not too difficult to develop performance measures while generating objectives. In fact, a useful strategy for generating objectives is to refer to tests used to measure performance in the past or ask faculty how they will measure an objective they are having difficulty defining.

One other point should be made concerning objectives. A common, and often justifiable, criticism of ID is that it results in doing better what shouldn't be done in the first place. Unfortunately, this is often far too true. By ignoring the inputs of students, parents and the public at large irrelevant curriculum is made to function better. This is a basic weakness of many if not all current ID models.

Design of System Components

Design of the components of the system includes specifying all instructional strategies and leads to arranging and sequencing both human and non-human resources. This may involve selecting certain existing components "off the shelf" in addition to preparing basic layout and treatment for unavailable components. Attention must be given to integrating the components and designing directions to the learner as well as general information and directions for faculty. Concern for faculty preparedness is another vital but often neglected area. Many a development project has failed not because the media segments were poorly designed, but rather because adequate attention was not paid to the skills and attitudes required of the implementing faculty.

Selection of various media for carrying the instruction must also be done while designing the system. Although a number of models for media selection have been generated, in the writer's opinion, they offer only limited assistance to the developer. Media selection models should be developed which account for type of learning, available resources and individual differences among learners. This is most unfortunate, but represents the current state of the art. Media selection and application of learning theory to instructional design are probably the weakest elements of any ID operation. Decisions are usually based almost exclusively on availability of the media, cost and the developer's bias toward or away from various media. Although the above are valid, legitimate criteria, considerable research is needed to develop a more inclusive guide for the developer.

In designing the instructional system decisions should be made as to individual differences in entry behavior, aptitude, motivation and learning styles. While it is fashionable to talk about individual differences, designers of instruction usually give them little attention. Nonetheless, such decisions should be made consciously and deliberately rather than conveniently ignored. It may be, for example, that given constraints of time, money and other resources, various individual differences must be ignored. But the developer should be aware of such decisions since they may help explain variance in later student performance.

Development of the Instructional System

Construction of the prototype or first draft of the instructional system includes activities such as script writing, execution of graphic materials, production of aural and visual materials and integration of media as indicated in the design. Training for faculty who will be implementing the prototype must also be conducted. The prototype is not merely a representation of the instruction, it is the actual proposed solution in the best form allowable under operational constraints. If a slide-tape is specified as part of the system, it should actually be produced rather than use a live narrator and a set of study prints during tryout. The purpose of the prototype construction is to build the "best guess" of what the system should look like. To do otherwise is to vitiate the prototype testing. Returning to the slide-tape example, if a narrator reads the script rather than actually using the slide-tape, he will not know whether it is the live narrator or the program itself which is effective (or ineffective). Many a developer has become sadder but wiser when his non-prototype tested out well but the actual prototype in a later trial was a disaster.

Generation of the prototype requires considerable reality testing in the form of cost, complexity, feasibility of producing, and perhaps duplicating the materials and training the faculty. It is not uncommon to make major modification in designs, treatments and media formats during prototype development. However, in all cases, the resulting prototype should look as much like the desired solution as possible.

Assessment of the Prototype

Testing the prototype and analyzing the data from the tryout represent the engineering approach to designing instruction. For this is exactly what an engineer does. He builds his model and then tests it under specified conditions. While one may decry the necessity of applying an engineering approach to instructional development, at the present time there is no alternative. There is simply not enough known about the design and development of instruction to avoid a tryout. To those who are concerned about the ethics of conducting a tryout of an unknown system on a group of students, I can only say that if all other factors mentioned earlier have been attended to the prototype should be at least as good as present practice and possibly even better. It is interesting to note that few people ever got excited about trying out unproven materials on students until it was made a deliberate, planned operation in developing instruction.

The prototype testing is usually conducted under two different sets of conditions. One set of conditions represents formative evaluation of the prototype to determine needed revisions. Conditions are arranged to maximize feedback to the developer on all aspects of the prototype from initial directions to teachers and students to closing summaries and final test instruments. If conditions are properly established the developer will collect data on the specific nature of any difficulties encountered. During formative evaluation it is usually desirable for the developer to observe closely all facets of the instruction and make on-the-spot revisions and assist students and teachers as necessary. He is less interested in their final performance than in their success in interacting with the system.

The other set of prototype tryout conditions represents terminal evaluation of the instruction. Under these conditions the objective is to determine the effectiveness of the instruction. During terminal evaluation the developer should attempt to duplicate the conditions under which the instructjion must eventually operate. At this point he wants to know if the system is meeting all the objectives which have been specified.

Data analysis is an integral part of both formative and terminal evaluation. During formative evaluation data are often analyzed "on line" while terminal data can often be examined in a more protracted and elaborate manner. Although inferential statistics may be useful for some data analysis, much analysis can be conducted with less sophisticated techniques such as means and modified gain scores.

At some point the instructional developer must decide to implement or recycle the instructional system. Even if the decision is to implement, the developer's work is not done since he should continue to examine the system over time to insure that changing conditions have not modified its performance; thus the process notion of ID having neither a beginning nor an end. On the other hand, if the decision is made to recycle, the developer must brace himself for another period of hard work. If recycling is necessary, it is usually due to his having ignored or failed to understand fully some critical element of the system. Thus, a useful point of reentry is to reexamine all stated and unstated assumptions. Of course it is also possible that the rapidly changing world has changed to such a degree that the system he was designing for no longer exists!

Conclusion

In this paper an attempt was made to give a brief overview of the writer's definition of instructional development. However, ID is an evolving concept. Each day and each new project add to one's perspective on what ID can be. I say "can be" deliberately since I do not believe it is an ultimate truth which man must discover, but rather a truth which he will define and redefine as necessary. New tools are being added to the repertoire of the developer, but much of what is done is still based on the biases and heuristics of those who engage in ID. Many decisions are made with minimal data and represent someone's best guess. The developer must operate from the position that some data are better than no data at all.

Although the writer has consistently referred to "the developer" as though he were an individual, ID is, in fact, usually carried on by a team. A team approach is often necessary for a variety of reasons. First, the vast array of skills required usually do not exist in a single person. At Michigan State University, for example, a team is likely to consist of at least one faculty member, a learning psychologist, a media specialist and an evaluazion specialist. A second major reason for using a team approach in ID is to insure accounting for all elements of the on-going system. Failure to account for every element of the system is almost certain to result in failure or early discontinuance of the development.

Current ID practice is focused mainly on the hard sciences and other areas in which we know how to write measurable objectives. It is also concentrated mainly on the cognitive and psychomotor domains. There is a great need for instructional development in the affective domain and in subject matter fields such as the arts, social sciences and humainties. Likewise, there is a need to find ways to apply ID to nonrecurring instruction which represents a significant portion of instruction.

If we are to develop a truly generalizable process applicable to all types of instruction in all areas, we must continue to search for new insights into how the ID process can be carried out. We have a powerful methodology in our hands, but if we are to truly revolutionize education as is so badly needed, we must strive to amplify its power by several orders of magnitude.

P.S. For those who are uncomfortable discussing instructional development without a flow chart, one is attached for your convenience.

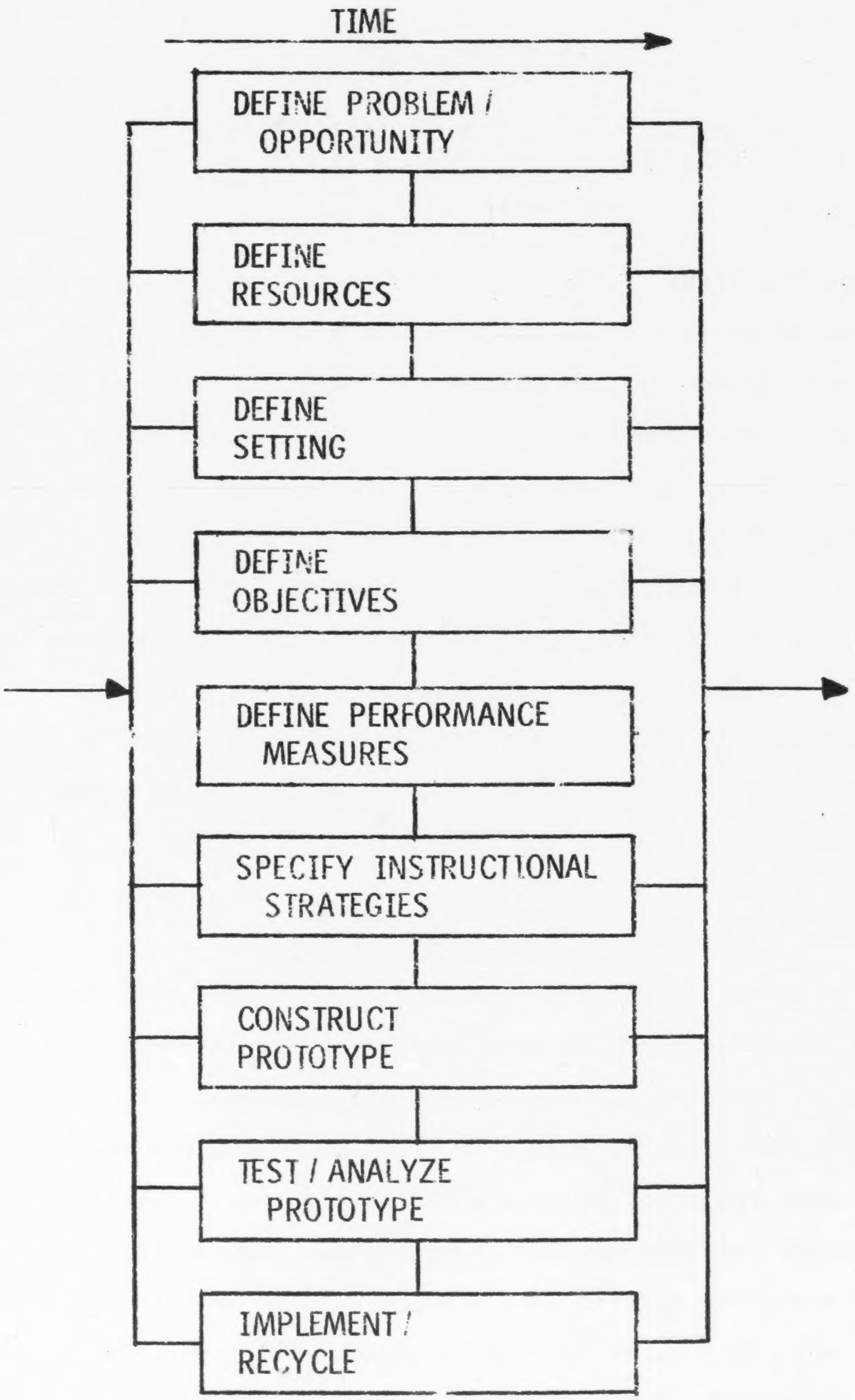

TIME
DEFINE PROBLEM / OPPORTUNITY
DEFINE RESOURCES
DEFINE SETTING
DEFINE OBJECTIVES
DEFINE PERFORMANCE MEASURES
SPECIFY INSTRUCTIONAL STRATEGIES
CONSTRUCT PROTOTYPE
TEST / ANALYZE PROTOTYPE
IMPLEMENT / RECYCLE

Figure 1: AN ID MODEL

Contribution Three

Towards A Definition Of Instructional Development: A Theory Based Approach

M. David Merrill

In the swing of the educational pendulum we have arrived at the point where the now thing is the development of instructional products. The initials R, D, D and E are on the very top of the current list of "in" words. At the recent AERA meetings, it was evident to all present that the name of the organization this year could just as well be changed to the American Educational Development Association. The U. S. Office of Education is stressing the development of educational products and is currently spending what money is available in development efforts. It seems very appropriate that we pause for a moment to examine the state of the art and to address ourselves to the question, "What is instructional development?"

A Current Model of Instructional Development

In spite of the many papers which have been written and the many flow charts which have been drawn illustrating the development process, almost every position includes the four elements illustrated in Figure 1. Perhaps the single most talked about topic in the area of ID is the specification of instructional objectives. It is pretty much agreed that unless one has specified what it is a student will be able to do it is difficult to specify instructional activities which will help him reach the goal. Perhaps less widely implemented, but widely discussed, are pretests. Most writers on the topic of ID have suggested that there is no need to teach a student some behavior which he has already acquired. Furthermore, to profit maximally from a given instructional product, a student is required to have attained a certain level of prerequisite skill. It is therefore advocated that having specified our objectives, the next part of an instructional development package should assess the student's prerequisite skills and his ability to already do the task being taught. The third, and most widely implemented component, is the preparation of instructional activities. This organization has been active over the past several years in stressing multi-media use in the presentation of instructional activities, unfortunately, whether or not they have had demonstrated value. The fourth component is the posttest. Some measurement must be attempted to assess the degree to which the student has acquired the objectives.

In Figure 1 the arrows from the posttest back to the instructional experiences and to the objectives indicate the iterative nature of development. Trying an instructional package with students means that adjustments must be made either in the instructional materials or in the objectives if the student is to acquire the behavior that is specified.

Widely Accepted Instructional Development Premises

Several premises are usually associated with current instructional development efforts.

> Premise 1: Objectives must be specified in observable student behavior.

Thousands of pages have been written on the necessity of specifying behavioral objectives. There is probably no one involved in development who is not familiar with Mager's classic book on specifying instructional objectives. Mager summed it up when he wrote, "If you don't know where you're going, you're liable to end up somewhere else."

> Premise 2: Only an instructional product which has been verified by empirical tryout should be considered a completed instructional development effort.

This might be labeled the "if at first you don't succeed, try, try, again phenomena." On the current list of "in" words are expressions such as, "accountability" and "quality control," which being interpreted mean that instruction should set out to accomplish specific goals and data should be gathered to find out if in fact these goals are being accomplished. If they are not, the instruction should be modified to be certain that the goals are attained.

> Premise 3: Tests used in instructional development should measure the students ability to perform specified behavior rather than how well he performs in comparison with his fellow students.

In technical language, tests would be criterion-referenced rather than norm-referenced. A well-developed product does not evaluate a student on his ability out-perform his fellow students, but on his ability to perform the behavior which is specified.

There are several problems associated with each of the above presumptions.

Premise 1: Objectives

(1) There is considerable question raised in some quarters about the value of behaviorally-stated objectives. It is frequently argued that as long as we are dealing with trivial behavior such as memorization or the learning of facts, it is a relatively simple matter to specify objectives; but when one deals with important behavior, such as problem solving or learning basic concepts of the field, behavioral objectives are no longer important because what is learned by the student is something other than observable behavior. This objection can be boiled down to the question, "How does one specify complex types of learning in terms of student behavior?"

(2) A second limitation of behavioral objectives is that after spending considerable time writing objectives, they are too frequently neatly typed, filed in a drawer, and forgotten. The use to which objectives can be put is not always obvious to the developers of instructional materials. Unanswered questions include: How does one use an objective to construct appropriate learning experiences? How does one use an objective to construct appropriate evaluation experiences? How does one use objectives or a set of objectives to appropriately sequence materials? I think this limitation can be summarized by the question, "After objectives, what?"

Premise 2: Empirical tryout

The "try, try again phenomena" is one of the real advances in instructional development. The greatest limitation is not this approach per se, but the way the development is guided prior to the empirical tryout. The procedure most often used is the "raw empiricism" approach. Instructional activities are designed using the best folklore and tradition currently available. The package is then tried to see if it "works." If not, it is revised until success is attained or the budget is exhausted. This process is extremely time consuming and, consequently, very expensive. Instructional materials developed on the first round are rarely if ever adequate in meeting and promoting the specified behavior. Too frequently they are not successful even after several revisions. The solution in too many cases has been to modify the objectives, assuming the initial objectives were unattainable.

An alternative to the raw empiricism approach is a theory guided development. This approach assumes that instructional theory can be specified and validated so that when used to guide development, many of the tryout-revised cycles would be eliminated. Given adequate instructional theories, it is possible that objectives could be attained in a period of time unlikely to ever be discovered by the trial and error of a raw empiricism approach.

Premise 3: Criterion-referenced tests

While considerable has been said about the importance of basing tests on the objectives and measuring the student's ability to perform a particular behavior rather than his ability to perform better than another student, there are numerous problems associated with this approach. Most serious is that advocates of this approach, especially in the programed instruction world, have flagrantly ignored that which is known about classical test theory and have consequently developed completely unreliable tests. If a test is unreliable, it cannot possibly be valid. Hence it measures nothing. The problem is easily illustrated. In many programs, a single test item is used to measure a relatively complex behavior. It has been pointed out by Gagne (1970) and others that complex behaviors require a set of items for adequate measurement, rather than a single item. Furthermore, reliability is a product of repeated measurement. The attempt to measure complex behavior with a single item does not provide enough repetition to make any inferences about subsequent occurrences of this behavior.

A second problem associated with criterion-referenced tests is that in spite of our preachments, the tests we use frequently do not follow from the objectives. The most frequent is thaz many tests measure only memorization skills in spite of the fact that the objectives specify problem solving or concept using behavior. Part of the problem stems from lack of ability to specify complex objectives.

Toward An Instructional Theory

In the next few paragraphs I would like to suggest some additional premises. These presumptions are not currently in wide use in instructional development, nor, I am sure, would they be accepted universally by those who presume the statements previously identified. I believe, however, that they do make possible the beginning outline of an instructional theory which might have some power in guiding theory-based instructional development.

> Premise 4: It is presumed that there is a limited number of different kinds of behavior and that any instructional outcome is an instance of one or more of these behavior classes.

This means that a given educational goal or objective can be classified into one or more behavior types. Confersely, each educational objective is not unique in itself but is similar to a set of other educational objectives in terms of the kind of behavior change required. Further, these classes of behavior run across subject matter lines. That is, objectives can be identified in English, mathematics, science, social sciences, home economics, auto mechanics, and physical education which are similar or identical in terms of the kind of behavior they require. Classification into a given behavior class is a result of the critical behavior required and the critical conditions under which that behavior must be observed. The word critical is used here to differentiate behavior and conditions which may vary and still have the objective remain a member of a particular behavior class (Merrill, 1971a).

The behavior classes identified, can be arranged in hierarchical continuum. That is, the behavior at one point in the continuum requires as a prerequisite some behavior in each of the previous classes. The horizontal axis in Figure 2. suggests such a continuum from emotional behavior through problem solving based on the work of Robert Gagne (1970) and subsequent modifications of Merrill (1971a). These categories have been described elsewhere and a detailed description of the basis for classification will not be repeated here.

> Premise 5: It is presumed that for each behavior class an optimal information processing strategy can be identified which if used by a student provides for optimal attainment of the specified behavior.

While differences exist in some of the parameters of the strategies (Clark & Merrill, 1971) it is suggested that the optimal strategy for one student is the same as the optimal strategy for another student. This does not eliminate the importance of individual differences. While it is presumed that the optimal strategy required is universal, differences still exist in prerequisite skills which a student has previously acquired prior to undertaking a given task, in his motivation toward the task, and in the particular parameter values required within the task itself. The vertical axis in Figure 2. illustrates these learner strategies. To avoid introducing confusing material for this presentation, the strategies are merely labeled level 1 to level 6. We do have some hypothesis about what such information processing strategies might look like, but these will be discussed at another time.

Corollary to this premise is that:

> Strategies used by students tend to approximate one or more of the optimal information processing strategies. While the strategy used by a student may vary somewhat from the optimal strategy, his success in acquiring the behavior will depend on the extent to which his strategy corresponds to the optimal strategy.

A second corollary to premise 5 is that:

> Given a task at a given behavioral level (see premise 4) the strategy used by a student in approaching the task may tend to approximate the strategy appropriate for a different level task rather than the strategy appropriate to the level of the task required by the behavior and conditions under which this behavior will be observed.

For example, when presented a list of names to memorize, students frequently employ a strategy which approximates a problem-solving strategy. If a strategy higher in level than the level of the task is employed, the learning may be successful but inefficient compared with the efficiency of the acquisition were the appropriate level strategy employed. It is also frequently the case that a student will attack a higher level task using a lower level strategy. A frequent example is to approach a concept-or problem-solving task with a memorization strategy. If this is the case, it is difficult or impossible for the student to adequately acquire the specified behavior.

The following fundamental presumption is the premise of the proposed instructional theory.

> Premise 6: It is presumed that by manipulating task variables, it is possible to facilitate the student's use of the appropriate optimal information processing strategy for a given type of behavior.

It is presumed that the primary purpose of instructional development is the manipulation of task variables in such a way that students will use appropriate strategies in acquiring given tasks. When instructional development has appropriately manipulated these task variables the resulting acquisition is maximally efficient, effective and enduring. It follows from this assumption that instructional theory is a set of prescriptions for this manipulation of task variables. This premise is the central idea of this paper.

An Example of Instructional Theory Validation and Its Application

At the American Educational Research Association in February (Merrill, 1971b) it was suggested that there are three levels of involvement with instructional design and development: (a) Level one, designers, teacher technicians or programers, are guided in their design efforts by cookbooks called "instructional design guides." These guides are so well specified that with very little training an instructional technician is able to develop appropriate instructional materials following the prescription of the guide. (b) Level two, designers, instructional technologists or instructional engineers have two functions: first, the development of instructional systems using all of the techniques and theory available; and second, the development of instructijonal design guides for use by those operating at the technician level. (c) Level three, designers, instructional psychologists or instructional scientists, have two levels of activity: first, the development of instructional theory; and second, the validation of such a theory through experimental investigation in both laboratory and field situations.

For the remainder of this paper, I would like to describe a research program which is attempting to validate an instructional prescription for one level of task. Suggestions for using this prescription to guide instructional development will also be presented. The level of behavior involved is concept classification. At this level the critical behavior is that the student will be able to correctly identify class membership of some object or event or some representation of an object or event. The specific behavior might be matching the name to the object, or discriminating an instance from a non-instance. The most critical conditions under which this behavior must be observed is that the instance presented to the student must be one that he has not previously encountered, that is, one that has not previously been identified as a member or non-member of the class in question. Again, a wide variety of specific conditions may be present. He may be presented a picture of the object rather than the actual referent, etc.

Figure 3. shows, in simplified form, an optimal strategy for acquiring such a behavior. If a student is to adequately acquire the ability to classify instances, he must first observe an example that is an instance. While being shown this instance the relevant attributes may or may not be called to his attention. This is another question for instructional research, but one that we will ignore for the current discussion. Having examined the example, he is presented a non-example which is matched to the example; that is, the non-example resembles the example except for the relevant attributes. This promotes the ability to discriminate members of the class from non-members of the class. If the non-example is carefully matched to the example, then the student would be able to observe those elements that are relevant and those that are not relevant. The third step is to present a divergent example. Most of the concepts with which we deal in school are so complex that they consist of many subcategories and one example may differ considerably from another example. The example presented for this third step should be one that differs considerably from the first example. This allows the student to observe the attributes in a different context and promotes generalization to all members of the class. In step 4 this divergent example is also contrasted with a matched non-example. This step promotes discrimination in a new context. The latter two steps are repeated depending on the complexity of the concept and individual differences. If there are numerous subclasses, then these steps need to be repeated until the student has seen the amount of variety possible within the context of the concept. Also, different individuals may need more repetitions than other individuals.

Task Variables

Earlier it was indicated that the purpose of this instruction is to manipulate task variables to promote the use of optimal strategy. At the present time three classes of task variables have been identified. (1) Prompting variables include hints, prompts, and other helps that are given to a

The second variable identified has already been described briefly as one we labeled "matching." An example is matched to a non-example when the pair have irrelevant attributes which are identical or nearly identical. Obviously there are degrees of matching, but for the experiment to be described, we simply used matched versus unmatched.

The third variable defined was divergent pairing. Divergent pairing relates examples to examples. A divergent pair of examples are two in which the irrelevant attributes are as different as possible. If the irrelevant attributes of two examples are the same, they are said to be convergent.

Markle and Tiemann (1971) had previously identified various types of classification errors which students frequently made in learning a concept task. These are overgeneralization, undergeneralization, and misconception. Overgeneralization occurs when the student correctly identifies all of the examples as class members plus identifying some non-examples as members of the class. In other words, the student fails to discriminate between classes. Undergeneralization occurs when the student identifies the more obvious examples as class members but indicates that less obvious examples are not class members. In other words, he fails to generalize to all members of the class. A misconception occurs when the student falsely presumes that an irrelevant attribute or combination of irrelevant attributes is relevant. The operational consequence is that the student fails to recognize examples not having this attribute as class members and student, and the kinds of knowledge of results given to a student about his response. (2) A second class of variables are stimulus similarity variables. How does one display or stimulus situation relate to another display or stimulus situation? It is this class of variables that we have investigated with the studies to be described. (3) A third class of variables deals with sequence. In the current instance, do you present the example and the matched non-example simultaneously or sequentially? There are other sequence questions dealing with random presentation versus systematic presentation, etc.

The studies to be described concentrated on stimulus similarity variables. Three specific stimulus similarity variables were identified. The first of these is one that is related to the difficulty level of an exemplar. Given an object to classify, some objects are easier to classify as a member of a class than others. In order to provide a more operational way of defining this particular variable, a probability level was calculated. A wide set of examples and non-examples were administered to a sample of students after they were given a definition. They were asked to classify each of the instances presented as an example or non-example of the defined concept. The percentage of students from the sample correctly identifying each instance as an instance and each non-instance as a non-instance were assigned to that particular item as the probability level. We have found that for most concepts which are taught in school, the distribution of percentages approximates a normal curve.

indicates that non-examples that do have this attribute are class members.

Hypotheses

Figure 4. illustrates the hypothesized outcomes of the study. Summarized they are as follows:

(1) If the instances represent a range of probability, examples are matched to non-examples, and examples are divergent with each other, then the student will learn to correctly classify previously unencountered instances.

(2) If instances are low probability, examples are not matched to non-examples, and examples are divergent with each other, then students will tend to overgeneralize when classifying previously unencountered instances.

(3) If instances are high probability, examples are matched to non-examples, and examples are divergent with each other then students will tend to undergeneralize when classifying new, unencountered instances.

(4) If instances range in probability level, examples are not matched to non-examples, and all examples are convergent on some attribute or set of attributes then the student will demonstrate a misconception when attempting to classify previously unencountered instances.

The Nature of the Experiments

Two experiments have currently been conducted with a third one underway. The concepts taught were trochaic meter, taught to college sophomores; adverbs, taught to junior high school students; and Rx2 crystal structures, taught to college sophomores. In each of these experiments a carefully constructed posttest allowed students to be scored on each of the classification errors identified above. There is not time to describe this test in detail. The reader is referred to the report of the original research. (Tennyson, Woolley & Merrill, 1971) In every experiment, the predicted outcome was supported at beyond the .001 level. The program designed to teach correct classification did teach correct classification. The hypothesized classification errors did result when programs were constructed to promote those errors. (See Figure 4) Figure 5. illustrates one of these sets of outcomes.

In summary, based on an instructional theory, specific "if-then" hypotheses were stated. Variables were carefully manipulated and all of the theoretical predictions were substantiated at well beyond the chance level.

Implications for Instructional Development

What implications does this research have for instructional development, and especially a theory-based instructional development? How would the preparation of a concept instruction lesson differ knowing the results of this experiment than would have been the case before? Having examined a large number of concept lessons, we have found that the typical procedure is to present a definition and one or two examples. Frequently the examples are convergent. Non-examples, especially matched non-examples, are almost never presented in concept lessons. Using the best folklore and tradition available, and the procedures typically used, we would predict that students would almost always undergeneralize or that they would frequently acquire misconceptions rather than to acquire correct classification behavior. No amount of empirical tryout under the "raw empiricism" procedure would eliminate the problems represented here. With enough repetition, a developer may be chance stumble on to the correct combination of exemplars and non-exemplars. In most cases, however, either the objectives would be seen as too difficult, or repetition would proceed until a student on his own resources finally acquired the concept and eliminated errors in spite of the instructor.

The steps involved in constructing a concept lesson based on the limited amount of instructional theory that we have discussed are as follows:

Step 1. The attributes on which the object or event is classified are carefully identified and stated in a precise definition of the concept.

Step 2. A large number of exemplars and non-examples are identified. The greater the variety that is found in this set of instances and non-instances the better.

Step 3. Having collected this large pool of examples and non-examples they are submitted to an instance probability analysis to determine the probability level of each instance and non-instance.

Step 4. Prepare a comprehensive classification error test. This test is constructed to allow one to detect over- and under-generalization and misconception.

Step 5. A set of displays is prepared in which examples and non-examples are carefully matched and in which examples are divergently paired. This set should be redundant enough to represent the complexity of the concept and to provide additional displays for students who may require more repetition than others.

Step 6. Conduct a dual control group validation study of the program. In comparison one, students receiving the program should be compared against students not receiving any instruction. In comparison two, students being presented a randomly selected set of instances should be compared with students receiving the carefully selected instances of the program. Based on the research that has been conducted thus far, it is hypothesized that a concept program constructed using these steps would require many fewer revisions and would be more effective than a concept program using the typical "raw empiricism" approach.

Summary

This paper has indicated that instructional development should be theory based rather than based on "raw empiricism". Second, the dimensions and possible form of an instructional theory was outlined in three premises. (1) It was presumed that a limited set of a behavior categories exist and that all behaviors can be classed into one or more of these categories. (2) It was also presumed that for each category there exists an optimal information processing strategy which would promote most efficiently and effectively the acquisition of that behavior. (3) Third, it was presumed that the purpose of instruction is to manipulate task variables in such a way that students are facilitated in using the appropriate information processing strategy.

One aspect of an instructional theory was described in relation to concept learning. An experimental investigation was described and steps for applying these principles to instructional development were described.

References

Gagne, R. M. "Instructional Variables and Learning Outcomes." Ch. 4 in M. C. Wittrock & D. E. Wiley (eds.) The Evaluation of Instruction. New York: Holt, Rinehart & Winston, 1970. Also in M. D. Merrill (ed.) Instructional Design: Readings. Englewood Cliffs, N.J.: Prentice Hall, 1971.

Merrill, M.D. "Necessary Psychological Conditions for Defining Instructional Outcomes." In M. D. Merrill (ed.) Instructional Design: Readings. Englewood Cliffs, N.J.: Prentice Hall, 1971a.

Gagne, R. M. The Conditions of Learning. New York: Holt, Rinehart & Winston, First Edition 1965, Second, 1970.

Clark, M. C. & Merrill, M. D. "A Cybernetic Modification Scheme for an Instructional System." In M. D. Merrill (ed.) Instructional Design: Readings. Englewood Cliffs, N.J.: Prentice Hall, 1971

Merrill, M. D. "Three levels of Instructional Design." Paper presented at annual convention of the American Educational Research Association New York: February 1971. Working Paper No. 15 Dept. of Instructional Research and Development, Brigham Young University, Provo, Utah, March 1971b.

Markle, Susan M. and Tiemann, P. W. "Conceptual Learning and Instructional Design" In M. D. Merrill Instructional Design: Readings. Englewood Cliffs, N.J.: Prentice Hall, 1971. Also The Journal of Educational Technology (London) Vol. I. No. 1, Jan. 1970.

Tennyson, R. D., Wolley, F. R., & Merrill, M. D. Exemplar and Non-Exemplar Variables which Produce Correct Concept Classification Errors. Journal of Educational Psychology, in Press, 1971.

FIGURE 1:
WIDELY ACCEPTED COMPONENTS OF
AN INSTRUCTIONAL DEVELOPMENT MODEL

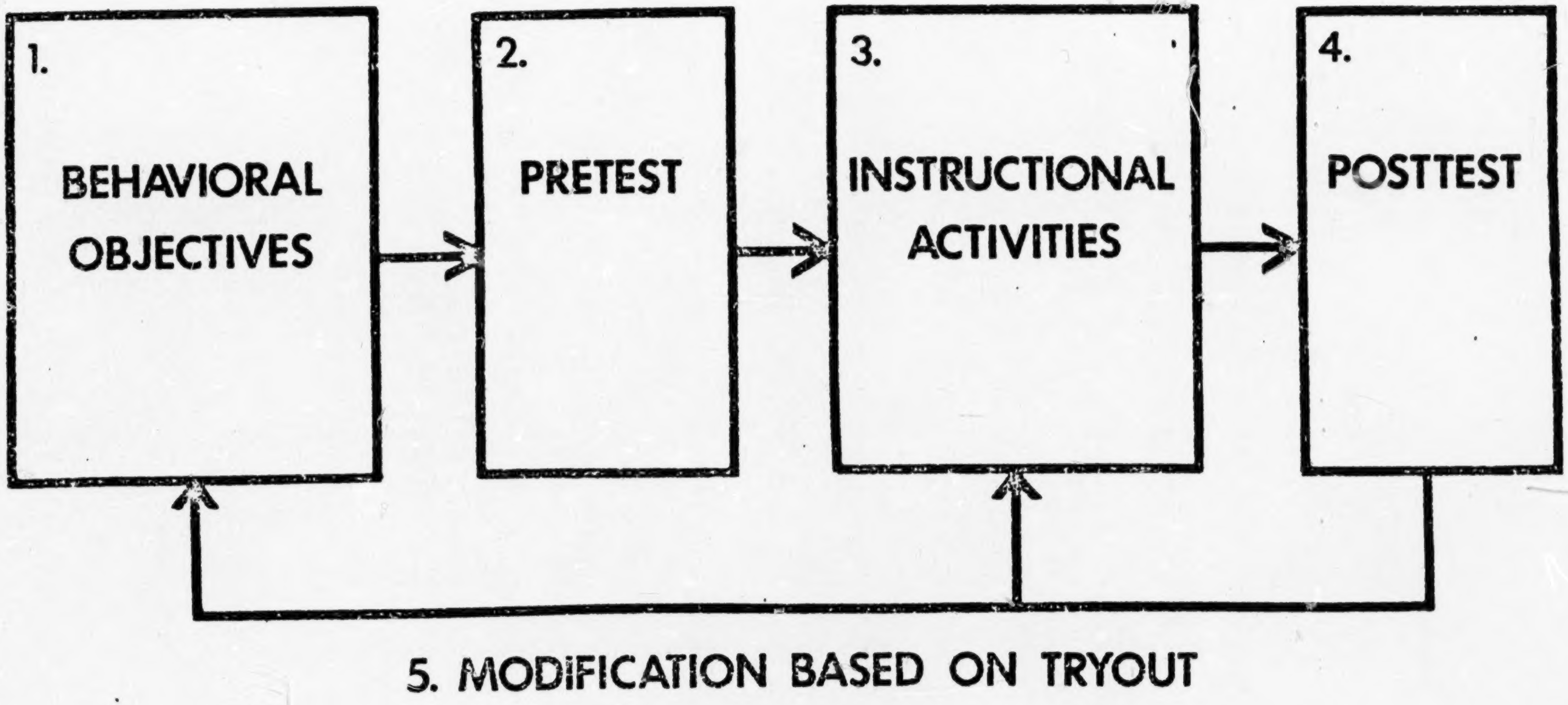

1.
BEHAVIORAL
OBJECTIVES
2.
PRETEST
3.
INSTRUCTIONAL
ACTIVITIES
4.
POSTTEST
5. MODIFICATION BASED ON TRYOUT

FIGURE 2:

PARAMETERS OF A THEORY OF INSTRUCTIONAL DESIGN

LEVEL OF OBSERVED BEHAVIOR

LEARNER STRATEGY	EMOTIONAL	PSYCHOMOTOR	MEMORIZATION	CLASSIFICATION	PRINCIPLE USING	PROBLEM SOLVING
LEVEL 1						
LEVEL 2						
LEVEL 3						
LEVEL 4						
LEVEL 5						
LEVEL 6						

FIGURE 3: OPTIMAL CLASSIFICATION STRATEGY

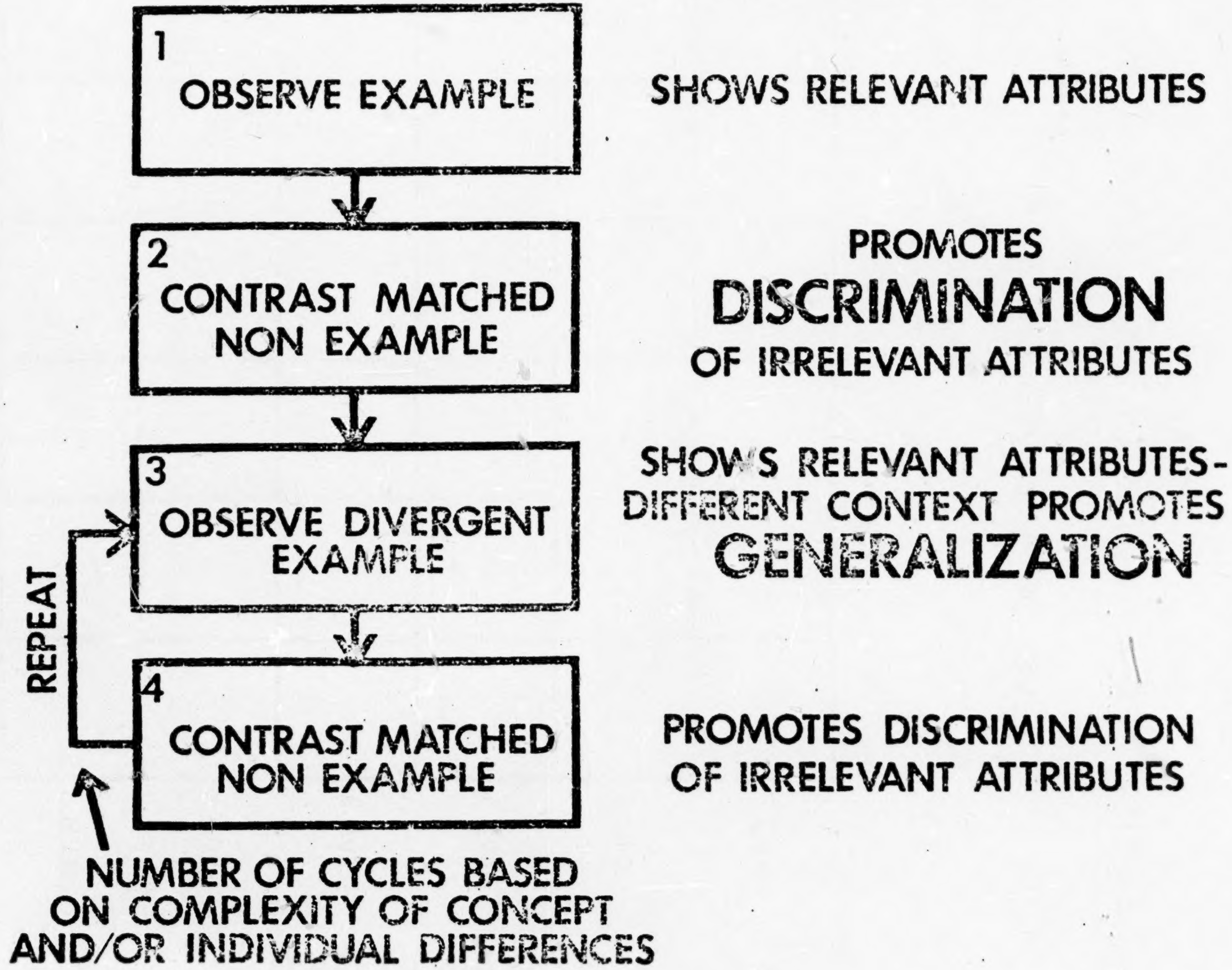

1
OBSERVE EXAMPLE
SHOWS RELEVANT ATTRIBUTES
2
CONTRAST MATCHED NON EXAMPLE
PROMOTES DISCRIMINATION OF IRRELEVANT ATTRIBUTES
3
OBSERVE DIVERGENT EXAMPLE
SHOWS RELEVANT ATTRIBUTES-DIFFERENT CONTEXT PROMOTES GENERALIZATION
4
CONTRAST MATCHED NON EXAMPLE
PROMOTES DISCRIMINATION OF IRRELEVANT ATTRIBUTES
REPEAT
NUMBER OF CYCLES BASED ON COMPLEXITY OF CONCEPT AND/OR INDIVIDUAL DIFFERENCES

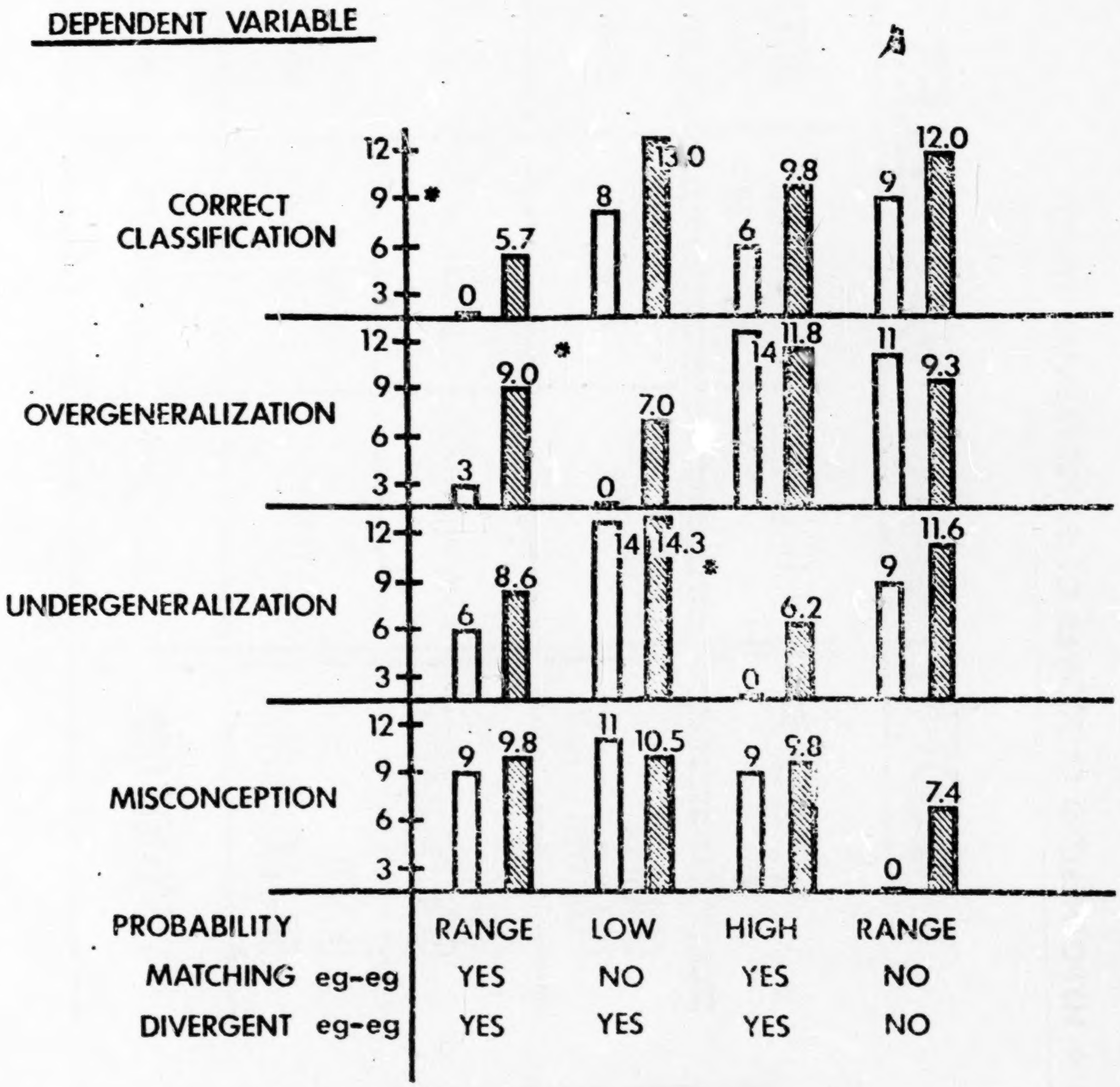
Figure 4: HYPOTHESIZED OUTCOMES OF EXPERIMENTAL STUDY

INDEPENDANT VARIABLES

PREDICTED OUTCOMES

	PROBABILITY	MATCHED eg → eg	DIVERGENT eg → eg
CORRECT CLASSIFICATION	RANGE	MATCHED	DIVERGENT
OVER GENERALIZATION	LOW or RANGE	UNMATCHED	DIVERGENT
UNDER GENERALIZATION	HIGH	MATCHED or UNMATCHED	DIVERGENT
MISCONCEPTION	RANGE	UNMATCHED	CONVERGENT

Figure 5: RESULTS OF CONCEPT CLASSIFICATION STUDY



Contribution Four

Towards A Definition Of Instructional Development: An Empirical Approach

Leslie J. Briggs

Instructional Technology, like other new fields of development, must try simultaneously to defend itself as best it can against those who oppose it, and to work from within to improve itself. It, therefore, must remain self-critical, while defending itself against its critics. It also will do well to use the comments of its critics for both the above purposes.

Since some of our cirtics accuse us of being over-rational and over-idealistic, yet rigid, we need to demonstrate our practicality and our flexibility, while seeking to improve our procedures on all fronts. To react well to both external and internal (self) criticism, we can carry on some needed PR work while doing the research and field testing needed to improve our technology.

Areas Requiring Investigation

Some of the following items appear to need our attention.

Cite Empirical Evidence of Successes

Too often we do explain our rationale rather than cite empirical evidence of our successes. When informing others about our theories, models, or approaches, it might be best to cite some results. For example, the first-aid training course developed for AT & T by A.I.R., under direction of the writer as program director, and David Markle as project director, showed that the trainees in the experimental course not only earned higher scores and a smaller range of scores, as compared to the control groups, but more striking, there was no overlap between the two distributions. While there are methodological precautions to be pointed out in making such comparisons, as long as the criterion measure is relevant for both the old and the new courses, such data are difficult to dismiss.

Demonstrate Applications in the Affective Domain

Today many educators are stressing affective or expressive objectives more than cognitive objectives. Thus our critics tend to say, "O.K., your approach might work for teaching first aid, or adding numbers, or other rather skill-oriented (or even "trivial" objectives), but show me an example of an application in the affective domain." Such work is needed to see just how our models may work or may need to be revised for this type of application.

Develop Examples of Applications for Broad Objectives or Goals

Examples are needed in which broad goals are first defined, followed by breaking these down into the kind of year-by-year specific objectives needed to show a "scope and sequence" for the curriculum. Then go on to the still more limited (or enabling) objectives which are needed for the detailed design of instruction for each year in the scope. While this is what all curricula should do, but don't (leaving huge gaps between the lofty goals and the curriculum content), our technology may not receive widespread acceptance until we can show that we can do this.

Determine the Level for Which Media Should Be Selected

An unsolved problem is whether media selection should be at the micro-level or the macro-level; that is, at the level of course units, specific objectives, subordinate (enabling) objectives, or instructional events within a subordinate objective. In short, in how big an instructional "chunk" should media selection be made?

Determine How To Select Media

A related problem is how to make the media-selection decisions, whatever the size of chunk employed. Could this be done by a cookbook or by a computer, or must the whole rationale be developed anew for each decision and each set of resource or boundary conditions? Teachers cannot apply many of our theory-based guidelines, and they don't know the practical production costs or other limitations. Could further research clarify both the "size of chunk" and the "how to select" problem in terms which both advance knowledge and provide guidance to those not so sophisticated in theory, research, and instructional design?

Clarify the Relationship Between Structure and Sequence

Some of the early experiments are thought-provoking, but fall short of clarifying the significance of hierarchical structure or stage of development to the sequencing of instruction. Some key experiments are now being done in this area, including those designed more specifically to address the sequencing question, and those designed to use path analysis as an empirical-statistical means for testing the assumptions in rationally-based hierarchies. Some definite progress may be expected on this problem soon.

Determine the Effects of Stating Objectives

What are the effects of behavioral objectives for the learner, the teacher, and the instructional designer? Do all three kinds of people need these objectives? How can the objectives be best used? Some teachers are forced to write behavioral objectives without being taught how to bring congruence among objectives, evaluation measures, and methods and materials. Knowing how to do this is important for designers and teachers, and this simplified "3-component model of instruction" can be used to explain to others the fundamental paradigm implied by instructional technology.

Objective-Referenced vs. Content-Referenced Teaching and Testing

A central concept in our technology is that objectives can guide our development of both learning materials and tests. We hear much about criterion-referenced testing, as distinguished from the conventional norm-referenced testing. But this latter distinction refers only to how scores are interpreted and reported, while the former distinction is more comprehensive and fundamental. A recent experiment, by the writer and others, found that when both instruction and testing are objectives-based, the test scores are higher than on a conventional content-referenced test. Furthermore, the correlation between the two tests was almost zero, i.e. not statistically significant. Future papers on norm- vs. criterion-referenced testing need to stress the entire differences between the two teaching and testing conventions; the significant features of these two conventions can be subsumed under the two headings of objective-referenced and content-referenced teaching and testing strategies.

Interactions of Developmental Level Media Choice and Instructional Strategy

Recent evidence suggests that age of the learner is a neglected factor in choosing media and instructional strategies. While print may be as effective for most objectives as any other media for college students, greater media differences may be expected for less sophisticated learners, as anticipated in Edgar Dale's "Cone of Experience." The implications of Dale's concept may not be fully utilized in either research or practice. Age-related media research could help spell out more clearly how this important concept may be applied.

Alternate Instructional Development Models

While we now have many models of instructional design, some more elaborate or more theory-based than others, we need a range of models for different degrees of sophistication in the user of the model, and models which fit differing resources and learning contexts. The personnel on the development team, the budget, and the nature of the target audience and the assumed learning environment, are clearly variables which should determine the specific model to be used in a given situation.

Development and Teacher Training

If educational technology is to have the impact in educational change for which many of us hope. clearly a drastic overhaul in the nature of teacher training programs is needed. If we assume that the schools are going to make dramatic or even appreciable changes, then if present teacher-training institutions do not make the appropriate adjustments, perhaps society will create new institutions to train teachers. If schools don't change, perhaps society will also find another type of educational institution. Our help is needed, and I hope it will be welcomed, to bring about the needed improvements in education. To that end, we must examine and improve our own research and practice; in short, to apply a systems approach to the analysis of our own mission.

Diffusion/Adoption of Instructional Development

Havelock has reviewed three models for bringing about change by diffusion of research knowledge and educational products. This writer finds all three models of the past to be unsatisfactory as predictors of future means for change, because the past models seem to assume a static society. A dynamic society will bring new sources of demand for change (and for accountability for change). When the people want change, they will get it. The writer expects to see more use of multi-organizational consortia as a major change agent; this may give us opportunity for greater impact. Let's be ready.

Conclusion

In order to improve our theory and our practice in instructional development, we must continuously re-examine our present practices and conduct research to improve the technology.

We need also to cite evidence of effectiveness of our present procedures, being sure to find examples in broad areas in the cognitive, affective, and psychomotor domains. We need new development models for analysis and testing and we need to apply them to teacher training. We need to organize our team approach to include the intended user in our initial planning for development. The delivery system should be planned concurrently with the development system and the management system.

Many areas of research remain to be pressed forward to answer such questions as these: do statements of objectives need to be given to the learner and the teacher as well as to the instructional developer? How should media selection be accomplished, and for what size of course unit? How can study of learning hierarchies help determine sequence of instruction? What are the implications of objectives for teaching and for testing? What learner characteristics interact with task characteristics, and what are the implications for media selection and design of the strategy of instruction?

All these activities need to be pressed forward if our technology is to have maximum impact upon introducing improvements into education and training.

Contribution Five

Toward A Definition Of Instructional Development: An Organizational Approach

Dale G. Hamreus

It is not my intention in this paper to present a specific model of instructional development nor to contrast several such models. Rather, I will attempt to identify where we seem to be today in our application of instructional development and to suggest areas I feel we must attend to if instructional development is to become an effective process in education.

The Nature of Instructional Development

I would define instructional development simply as a systematic process of bringing relevant instructional goals into effective learning activity. Consider for a moment: an instructional idea is born; it becomes defined in terms of specific goals and outcomes; which are translated in turn, into instructional design specifications; from which instructional products are fabricated; which are then tried out and revised until desired results are achieved with learners; the total of which requires a continuous flow of information.

Characteristics of Instructional Development

Although the principle of instructional development, as expressed in the above definition, is a rather simple one and fairly easy to grasp in a global sense, certain characteristics of the development process are often not clearly perceived. Four such characteristics which emerge from the above definition are crucial to the successful application of instructional development and must be understood. The first characteristic I call *goal definition*. Only after a goal has been clearly defined and stated in words that permit a yes/no judgment to be rendered regarding whether the goal has been achieved can the developmental process be appropriately applied. One can work continuously at building some instructional product, for example, but until he clearly perceives what end learning results his development should achieve he never has a basis to know whether he has successfully built the desired product.

The second characteristic I call *goal relevance*, which is clearly related to the first but significantly different. Even though the instructional goal could be clearly defined to permit effective application of development, if it has little or no relevance to the constraints of the educational establishment it serves no good purpose. Too often developmental efforts have consumed much time, effort and resources only to be rejected by teachers, learners and parents who fail to see its worth.

The third characteristic is that of being *systematic*. Although anyone can develop an instructional lesson by simply assembling various teaching resources, effective instructional development can only take place when very carefully planned and detailed procedures are set forth and *followed*. General guidelines for such procedures are typically defined in the various models of instructional development.

The fourth characteristic is evaluation directed. The only possible way that effective learning activities can emerge from development efforts is by providing continuous evaluation of the endeavor. Not only must the finished product of instructional development be evaluated to determine how well it works, in addition the total process of development must be continuously monitored and assessed to permit timely and wise decisions to be made in choosing among various possible development alternatives.

Current Status of Instructional Development

Numerous instructional development models have emerged over the past ten years as a result of the development efforts of specific individuals and/or agencies. Examples of such models include: The Corrigan and Kaufman Problem Solving model (Corrigan and Kaufman, 1966); the Michigan State University Instructional Systems Procedures model (Barson, 1967); the HumRRO Training System Development model (Crawford, 1967); the Tracey Instructional Systems Design model (Tracey, 1967); the Teaching Research Systems approach to Instructional Development model (Hamreus, 1968); and the SWREL Product Development Technology model (Baker, 1971). Such models are, by and large, process oriented, i.e., defining instructional development in terms of the procedures and/or steps required to produce the desired outcomes (products). The benefits resulting from such a process orientation has been the definition and refinement of operational techniques and tools which provide the means for conducting development.

Techniques of Instructional Development

Some of the techniques that are being used by instructional developers include the following:[1]

1. Needs assessment
2. System analysis
3. Behavioral objectives
4. Methods-means selection
5. Network planning and management
6. Product fabrication
7. Testing and evaluation
8. Feedback

I am sure you recognize most, if not all, of these items. For the sake of clearer understanding, however, let me give a sentence description of each.

1. Needs assessment refers to the technique of determining what instructional system(s) should be developed and provides a basis for judging the adequacy of current instruction.

2. System analysis is a careful analytic procedure for disecting and inspecting as much of the instructional system as is possible to determine its current state of affairs.

3. Behavioral objectives is a process of designating specific desired learning outcomes and converting them into descriptive statements that indicate what is to be accomplished,

---

[1] The list was selected, and slightly modified, from a larger list provided by Roger Kaufman in his article, "Accountability, A System Approach and the Quantitative Improvement of Education--An Attempted Integration." Educational Technology, January, 1971, p. 23. Kaufman provides a terse but useful description of each of these "tools" along with a good list of references.

by whom, under what conditions, and to what level of criterion.

4. Methods-means selection is a technique of determining the requirements or specifications of instructional media, contents, settings and teaching strategies for achieving the specified behavioral objectives.

5. Network planning and management is a formal process of estimating the time and resources required to complete the various instructional development tasks such that they can be properly managed.

6. Product fabrication is simply the conversion of instructional development specifications, generated under 4. Methods-means selection, into actual products, i.e., slides, printed materials, audio tapes, films, etc.

7. Testing and evaluation concerns the procedures for trying out the instructional product being developed, assessing its effectiveness in producing the desired outcomes, and for deciding which of several possible alternatives to follow.

8. Feedback is not so much a formal technique as it is a procedural precaution to always review previous actions and decisions against subsequent effects and to make adjustments throughout the total development process accordingly.

Each of the above techniques and/or tools of instructional development when inserted into the appropriate step of an instructional development model provides the instructional developer with a process by which he, given sufficient "artistic" sensitivity, can produce effective products. The problem is that the instructional development process doesn't always work. More accurately, it doesn't always work to the advantage of educational agencies who are in the business of teaching people. It works well enough for developers in R & D Centers, Regional Laboratories and other similar research agencies, but unfortunately, their products do not get into the actual teaching-learning setting in sufficient numbers nor for a long enough period of time to consider the development efforts to be very cost-effective.

Another way to say this is that, by and large, the instructional development expertise that is possessed today exists primarily outside the school context where teaching and learning takes place; and since our models of instructional development essentially do not encompass procedures for effectively and efficiently interfacing with schools, proportionately only small benefits are being derived from the development efforts.

Problems of Instructional Development

What are the problems with instructional development as it is now known? I would argue they are basically of three types. The first concerns the lack of clear understanding of the principle of instructional development, the second concerns the level of technical skill possessed by developers and the third concerns who is involved in the instructional development process and how they are involved.

First, the understanding of the principle of instructional development. This I consider to be the most crucial problem. If those who attempt to engage in instructional development do not perceive what instructional development is all about and appreciate the importance of its various characteristics, we stop right there. It is essential that concerted effort be made to accurately communicate the meaning of instructional development not only to those who profess to be developers but also to those who must and should interface with the development process.

Second, let's look at the technical skill level. In reviewing the eight techniques I listed earlier, it is obvious that certain deficiencies exist. For example, although the concept of needs assessment appears to be fairly clearly understood, the methodology for actually assessing needs is not too precise nor do we have much sensitivity yet about when to employ alternative strategies in assessing the needs of various and differing populations.

We do appear to have a fair amount of competence in writing behavioral objectives, however, we fall back to an art form rather abruptly when it comes to determining, from needs assessment data, what behavioral objectives to write. I know of no techniques for this later task.

Then, there is the methods-means selection technique. I feel we are very limited in our technical knowledge of this procedure. Other than some crude rules of thumb and the intuitive insights of certain experienced designers, we just don't have the technical data necessary to decide specifically what type of media should be utilized for teaching which specific learners what various behaviors and the optimum settings and sequences required therein.

Each of the other remaining techniques could be commented on in a similar manner, but the point is simply that whatever their deficiencies they reflect the current state of the art in instructional development. If we didn't understand the principle of iteration, i.e., the continual trial and refinement process, our current techniques wouldn't get us very far. Without question, continued study and refinement of these techniques must occur.

Now, let's consider the third type of problem: Who is involved and in what manner in the instructional development process? As it now stands, systematic development is limited principally to those persons who are in formally established research agencies and organizations that specialize in development. School personnel, in general, have neither the time, the training, nor the funding base to conduct systematic instructional development. The effects of this division of labor in development efforts, in my opinion, is the most outstanding reason why currently instructional development is achieving only limited success.

Let me cite an example. In 1968, the U. S. Office of Education awarded grants of nearly four million dollars to three large development firms: Westinghouse Learning Corporation, The New York Institute of Technology and the Sterling Corporation, to design and develop three independent multi-media programs to be tested at the U. S. Naval Academy at Annapolis. The New York Institute of Technology had the responsibility for a beginning college physics course. As reported in the AIP Educational Newsletter, "the project was designed without review or advice from the Commission on College Physics, the American Association of Physics Teachers, or the American Institute of Physics."[2] The newsletter goes on to comment that "While some of the psychologists involved in the project were able to detect significant differences in the amount of learning achieved, many physicists, however, questioned not only the merits of the course objectives that had been adopted in the first place, but also whether such fragmentation of a standard physics textbook did not destroy its original educational goal."

The unfortunate implications from the above example are that even though apparent good learning results were achieved from the product of the development effort, the possibility of schools adopting the multi-media program appear not to be good. Even the adoption of the program by the Naval Academy is a matter of doubt, as reported at the 1971 Annual AERA Conference, since the number of staff involved from the Academy were very limited and apparently no commitments were made.

---

[2] American Institute of Physics, AIP Education Newsletter, Vol. XIII, No. 9, November 30, 1970.

New Concerns

All this is leading me toward a definition of those aspects that I feel must be included in instructional development if we are to become more successful in its application. Consider Figure 1.

	Size of Development Effort		
PERSONNEL	Self-Contained Package	Component of a larger system	Total System
Developer	critical	critical	critical
User-teacher	minimal	critical	critical
School Management	unnecessary	moderate	critical
Other Constituents	unnecessary	minimal	critical

Figure 1. Instructional Development Size/Personnel Involvement Matrix

In Figure 1., I have identified three sizes of projects that typically get developed: (1) the package size, which is self-contained and can be purchased and inserted in a course by a teacher either as a supplemental element or to replace some specific lesson segment; (2) the component size, which constitutes a major unit of study in a course and which must be designed to dovetail nicely with that which already exists; and, (3) the total system size, which is usually a total course or even a curriculum and either replaces an existing one or creates a new one.

Also in Figure 1., I have identified personnel who have some stake in the educational enterprise: (1) the Instructional developer; (2) the user-teacher, or the persons who will be responsible to manage the product of development in the teaching-learning setting; (3) the school management, or those administrative type personnel to whom the user-teacher is responsible, i.e., the principal, superintendent, dean, chairman, etc.; and, (4) the other constituents, or the patrons of the school who are concerned that quality and relevant education is being provided learners, i.e., school board members, association members, interested publics.

Now consider the cells of Figure 1. from the standpoint of the level of involvement suggested for each personnel type in terms of the size of the development effort. Developers are obviously critically involved in all development sizes. User-teachers are only minimally required in package size development. Remember, these are the small, independent development products that can be sold like a textbook and, if adequately specified and advertised, will be purchased by user-teachers to satisfy specific needs. Involvement of user-teachers might be at a level to assure the developer that formats are attractive and understandable and that instructions for use are clear. In terms of system components and total system development, user-teacher involvement becomes critical. If adoption of the product of development is to have any chance of occurring, subject matter specialists and classroom teachers must participate in the planning, development and evaluation of the product.

It would seem that both school management and other constituent personnel need not become involved in the package development size. They both can be convinced of the merits of the package if sufficient promotional attention is given. School management personnel are probably moderately required in component size development efforts if the teacher is to be successful in inserting it into a larger curricular structure. However, at the total system development size it becomes critical to have school management personnel involved. If they are not convinced of its importance and relevance, the development will not survive.

It is suggested that other constituents should have minimal involvement in component size developments. They carry enough weight that they should at least be consulted for approval. At the total system development size, it becomes critical to involve other constituents. We must solicit evidence of relevance from other constituents regarding curricular contents, without which we continue to take risks of lack of support and only by which are we, in the words of Leon Lessinger, ever to achieve a level of accountability.[3]

Let's take another look at Figure 1 with something new added. Consider Figure 2.

---

[3] Leon M. Lessinger, "Robbing Dr. Peter to 'Pay Paul': Accounting for Our Stewardship of Public Education." Educational Technology, January, 1971, p. 14.

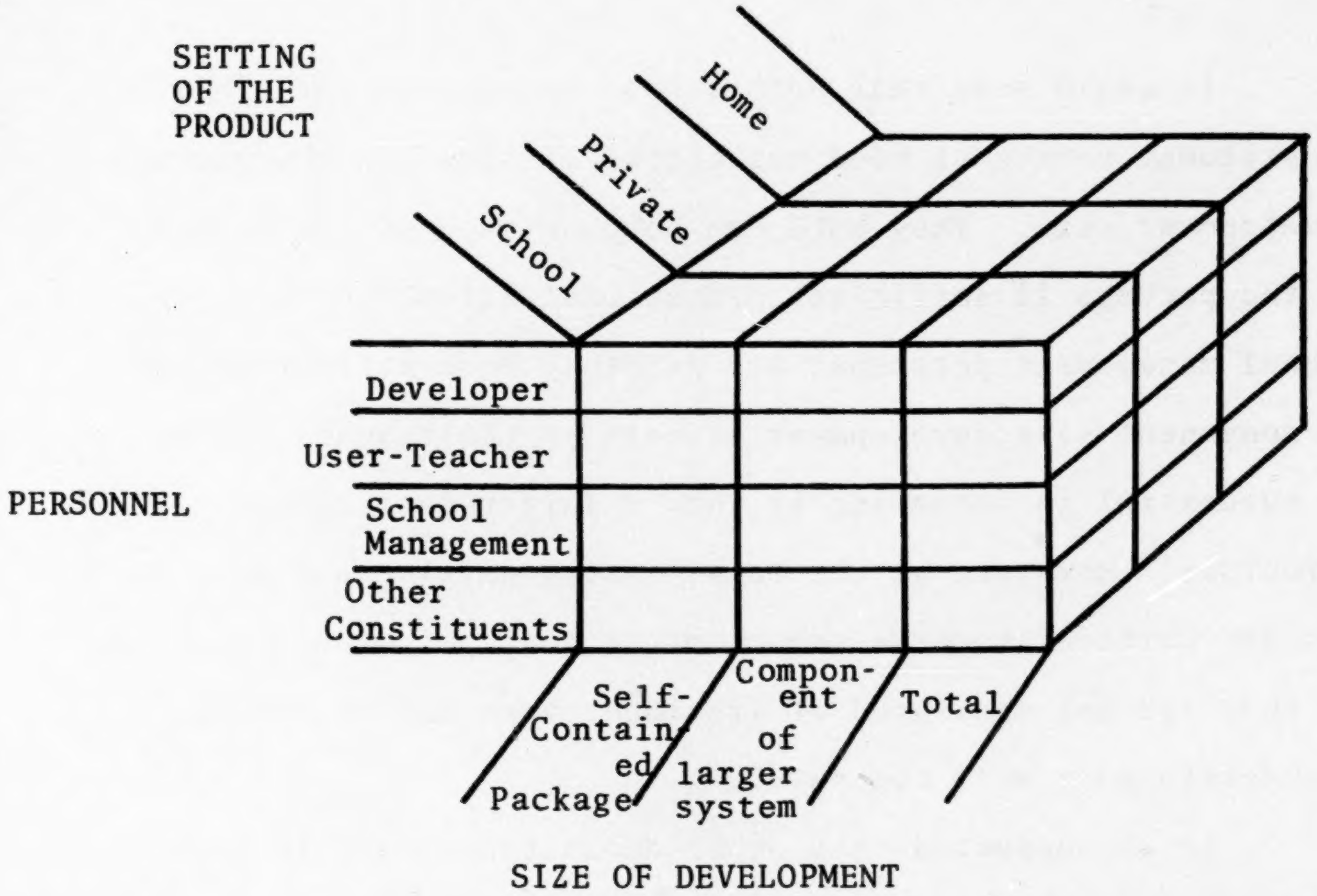

SETTING OF THE PRODUCT
Home
Private
School
PERSONNEL
Developer
User-Teacher
School Management
Other Constituents
Self-Contained Package
Component of larger system
Total
SIZE OF DEVELOPMENT

Figure 2. The Setting Complex of Instructional Development

Figure 2. is simply Figure 1. rearranged with a third dimension, Setting of the Product, added. The third dimension concerns the primary setting in which the product of the instructional development effort will be used. The greatest share of such products are beamed for use in the schools, whether it be elementary-secondary, community college, university, or otherwise. Private industry has a degree of use of the products of development and the future might see considerable more. The home is a relatively new setting but since SESAME STREET, both the TV and printed products, increased development of instructional products to be used in the home can be expected. The question is what type of involvement should different people have with respect to size of product and setting of its use?

The illustration in Figure 2 is only intended to lay out the dimensions of this question rather than to propose an answer. However, the answer is important to the ultimate success in defining relevant goals, deriving effective products and having them accepted for use.

Conclusion

In this paper I have tried to consider some of the aspects of instructional development which I feel must be given attention if we are to arrive at a meaningful definition of instructional development. (I am using the term "definition" at this point in its broader and more comprehensive form rather than in a simple sentence form like I gave at the beginning of the paper.)

I feel such a comprehensive definition of instructional development must include attention to three main factors: (1) clarification of the principle of instructional development including its unique and specific characteristics; (2) delineation of the techniques or "tools of the trade" and the limitations of each with respect to their application; and, (3) identification of who should be involved in the instructional development effort and how those involvements differ with respect to tasks to be performed, settings in which to operate and types of products to be developed.

It is obvious to me that by limiting the concept of instructional development to including only a team of technicians who are skilled in the techniques of the technology of development will only lead to "techiness" on the part of users.

We must broaden the concept of instructional development if it is to become viable; which calls for a broadening of its understanding among those who it involves.

References

Baker, Robert L. "Product Development Technology," paper presented at AERA Session S 6-1, Developments in Educational Technology, New York City, February 5, 1971.

Barson, J. Instructional Systems Development: A Demonstration and Evaluation Project. U. S. Office of Education, Title VII-B Project OE-3-16-025. Michigan State University, 1967.

Corrigan, R. E. and Kaufman, R. A. "The Steps and Tools of the System Approach to Education." Operation PEP, Tulare County Department of Education, Visalia, California, 1966.

Crawford, M. P. Research and Development Training Education. Professional paper 18-67. HumRRO, The George Washington University, Alexandria, Virginia, 1967.

Hamreus, Dale G. The Systems Approach to Instructional Development. Teaching Research, Monmouth, Oregon, 1968.

Tracey, W. R., Flynn, E. B., Jr., and Legere, C. L. J. "Systems approach gets results." Training in Business and Industry. June, 1967, 17+.

Postscript

"....for there is nothing either
good or bad, but thinking makes
it so."
William Shakespeare

Definitions, by their very nature, have an air of finality about them; a proclamation, as it were, of agreed dogma. Instructional development is not at this stage, perhaps fortunately so. Definitions, however, have an additional or even alternative property. They can help the process of delineating a field by assisting the inclusion/exclusion process. They have a formative, as well as an summative, property. Instructional development is now at a stage where this process can be helpful.

In this monograph five suggested definitions, or ingredients of development have been proposed. Some readers may have embraced some and rejected others; other readers may feel that the definitions offered have tended to be vague and lacking in precision; still others may wonder about the utility of what has been offered, and its meaning in the real world.

As Hamlet remarked, things are rarely good or bad, we confer this property. In the present formative state of instructional development, we are indeed fortunate that there is such a richness of diversity and spirit of inquiry. It would be so easy and convenient to issue ex-cathedra pronouncements about the nature of ID, as so often happened in the early days of programed instruction. The unwillingness of the five contributors to do this signals a degree of maturity that our youth would belie.

Having had the ground for open-mindedness and inquiry, the editors can afford to ignore this position. They steadfastly and dogmatically proclaim the essence of instructional development in the formulae displayed below.

> Instructional development is concerned with:
>
> 1. the recognition of the objectives (or intents) of both a learning task and the participants involved.
> 2. the feasibility of realizing these objectives (or intents) within the two constraints of:
>   a. necessarily limited resources, and
>   b. adequate measures of the effectiveness with which both sets of objectives are achieved.
> 3. the comparison of alternative strategies and tactics for achieving feasible objectives (or intents).
> 4. the choice or selection of a best or optimum alternative so as to:
>   a. realize these learning objectives (or intents)
>   b. increase student interest, enthusiasm and motivation to the task in hand, and
>   c. maximize learning efficiency
>
>   in the context of an appropriate use of available resources.
> 5. the execution of this decision process into an effective and worthwhile instructional program.
> 6. the continual on-going re-cycling and refining of the above 5 concerns so as to sharpen and enrich the total learning experience.
> 7. the successful selection of the optimal point to stop development and hand over the program, since further development is unlikely to be worthwhile or meaningful and even be harmful.

Offering a formative definition in these terms, is an alternative to the position taken by the five principal contributors. The aim is not to define the field, and so stunt further growth and development. Straw men can have a useful role to play. The discussion they inevitably provoke is another way of encouraging evolution and progressive development.

Indiana University
April 12, 1972

Ivor K. Davies
Thomas M. Schwen